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ROYAL SOCIETY
OF
TASMANIA

PAPERS & PROCEEDINGS

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OF TASMANIA

FOR THE YEAR

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THE ROYAL SOCIETY OF TASMANIA

The Royal Society of Tasmania was founded on the 14th October, 1843, by His Excellency Sir John Eardley Eardley Wilmot, Lieutenant Governor of Van Diemen's Land, as "The Botanical and Horticultural Society of Van Diemen's Land." The Botanical Gardens in the Queen's Domain, near Hobart, were shortly afterwards placed under its management, and a grant of £400 a year towards their maintenance was made by the Government. In 1844, His Excellency announced to the Society that Her Majesty the Queen had signified her consent to become its patron; and that its designation should thenceforward be "The Royal Society of Van Diemen's Land for Horticulture, Botany, and the Advancement of Science."

In 1848 the Society established the Tasmanian Museum; and in 1849 it commenced the publication of its "Papers and Proceedings."

In 1854 the Legislative Council of Tasmania by "The Royal Society Act" made provision for vesting the property of the Society in trustees, and for other matters connected with the management of its affairs.

In 1855 the name of the Colony was changed to Tasmania, and the Society then became "The Royal Society of Tasmania for Horticulture, Botany and the Advancement of Science."

In 1860 a piece of ground at the corner of Argyle and Macquarie streets, Hobart, was given by the Crown to the Society as a site for a Museum, and a grant of £3,000 was made for the erection of a building. The Society contributed £1,800 towards the cost, and the new Museum was finished in 1862.

In 1885 the Society gave back to the Crown the Botanical Gardens and the Museum, which, with the collections of the Museum, were vested in a body of trustees, of whom six are chosen from the Society. In consideration of the services it had rendered in the promotion of science, and in the formation and management of the Museum and Gardens, the right was reserved to the Society to have exclusive possession of sufficient and convenient rooms in the Museum, for the safe custody of its Library, and for its meetings, and for all other purposes connected with it.

In 1911 the Parliament of Tasmania, by "The Royal Society Act, 1911," created the Society a body corporate by the name of "The Royal Society of Tasmania," with perpetual succession.

The object of the Society is declared by its Rules to be "the advancement of knowledge."

His Majesty the King is Patron of the Society; and His Excellency the Governor of Tasmania is President.

ROYAL SOCIETY OF TASMANIA

PAPERS AND PROCEEDINGS, 1920

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PAPERS

OF THE

ROYAL SOCIETY OF TASMANIA

1920

STUDIES OF TASMANIAN CETACEA.

PART IV.

Delphinus delphis

(The Common Dolphin.)

By

H. H. SCOTT (Curator, Victoria Museum, Launceston)

and

CLIVE E. LORD (Curator, Tasmanian Museum, Hobart).

Plates I.-V.

(Read 12th April, 1920.)

As with other members of the *Cetacea* the synonymy of this species is involved. Beddard [1] states that the following appear identical with *Delphinus delphis*: *D. major*, *D. fulvofasciatus*. *D. fosteri*, *D. janira*, *D. pomeegra*, *D. bairdii*, *D. moorei*, *D. walkeri*, *D. novæ zelandiæ*, *D. albimanus*, *D. marginatus*, *D. fuscus*, *D. souverbianus*, *D. variegatus*, *D. balteatus*, *D. algeriensis*, *D. moschatus*. While agreeing in general terms with this combination of synonyms we wish to qualify it with certain remarks later in this paper.

The dolphin is common around the Tasmanian Coast and in the estuaries of the larger rivers, sometimes ascending them for many miles from the open sea. During the currency of the Easter Camp of the Tasmanian Field Naturalists' Club at Port Arthur we were fortunate in observ-

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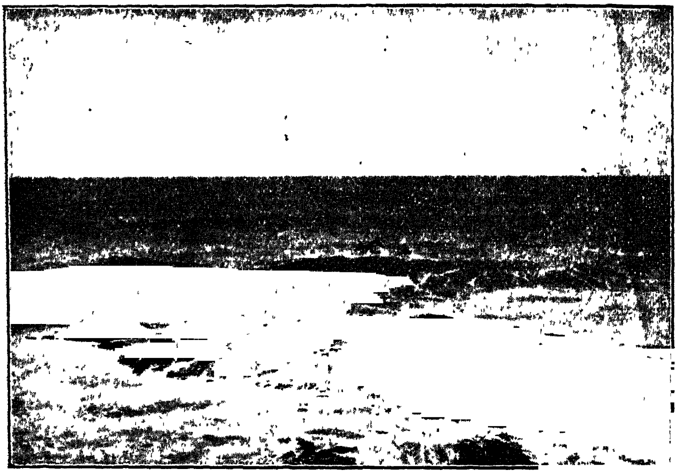
(1) Beddard: A Book of Whales (1900), p 254.

ing a large number of dolphins in Maingon Bay, Tasman's Peninsula. There were several hundred dolphins in the bay and their evolutions in the surf were watched with interest by many of the Naturalists for the greater part of Easter Monday. It appeared as if the animals were mating. The greater majority kept out in the waters of the bay beyond the line of breaking ocean combers that broke rank after rank upon the coast. Every now and then, however, a score or more would come dashing towards the shore, their outlines showing clearly in the incoming breaker. Just at the moment the wave broke and it appeared as though the dolphins would be cast against the rocks or flung far up on the sandy shore, they would turn suddenly, dive through the crest of the breaker, spring



several feet in the air, and once more swim seawards. Such a sight needs to be actually observed before one fully realises the immensity of the swimming power possessed by these aquatic mammals. The enormous force of the breaking waves, the various cross currents and undertows incidental to such a surf seemed to have no effect upon the evolutions of the dolphins. Although accustomed as we were to observe the swimming powers possessed by these animals from vessels and on other occasions from time to time, yet it needed such an observation as the foregoing to fully realise the power of these animals in their natural element. (See Plate I. and text fig. 1.)

EXTERNAL CHARACTERS.

Although it is here assumed that the modern method of reducing all the smaller dolphins to a single species (that of the type) is a more or less wise one, it must still be claimed that such a proceeding leaves certain outstanding facts unaccounted for. In a word such a species as that of "*Delphinus fosteri*," having apparently well marked external characters, and some slight skeletal ones, does not agree in all respects with the large eight feet dolphins that frequent our coasts, and of which we hold a complete skeleton, and a set of notes made upon the animal prior to dissection. Perhaps the best that can be done at present is to regard the better defined species of former classifications as being sub-races, and to sink *in toto* all the ill-defined ones. The more one studies the *Cetacea* the more the conviction grows that we are dealing with a rapidly evolving order of marine mammals, and that within certain limits, taxonomy is tentative and certainly unworkable if pushed to extremes. We herewith detail the external appearances of two animals, one a mature male of eight feet in length, and the other an immature male of six and a half feet in length—exact measurements being included.

Mature Male.

Between the dorsal fin and the head the animal was jet black. From the constriction of the beak to the eye ran a curved black line—outlined and washed with white. From the eye to a line drawn vertically with the back of the dorsal fin was a curved line, above which the animal was black, and below which the colour shaded from dirty grey to white. In the tail regions a good deal of iron grey appeared, and it was assumed that, in young animals, the grey, white, and iron grey, would appear as yellow, thus giving rise to such a vernacular name as "yellow sided dolphin." The actual flukes of the tail were black.

Immature Male.

In the arrangement of the several colour areas this young male simulated the adult animal, but the white of the underparts was replaced by yellow, or more correctly, yellowish white. This animal came from the Derwent River and was as nearly adult, in point of measurement, as nine and a half is to twelve. Smaller animals, from the same river, in the collection of the Hobart Museum, show much deeper yellow tinting along the underparts—

thus pretty clearly showing that yellow sided dolphins are immature animals. Individually, the young male here under description manifested two, irregularly oval, white marks in the region of the tail, but otherwise conformed to the adult tinting, except in the matter of yellow replacing white upon the under parts—as already stated.

Food.

During the dissection of the adult animal the stomach was turned out, and found to contain a fair amount of semi-digested food, and an enormous number of the horny beaks of cuttlefish, also a few worms. The immature animal had apparently been feeding upon *Echinoderms*, as large quantities of *Spatangus* spines were found, and were the only undigested elements met with.

Ribs and Scapula.

As the scapulæ are frequently misplaced in articulated dolphins' skeletons, a measurement was made prior to the removal of the scapulæ of the immature animal to exactly fix its position. The numerical result was—from tip of beak to anterior rim of scapula = 21½ inches when the arm was at a right angle to the line of the body. As a guide to articulation, therefore, the hamular process should just overlap the edge of the first rib. In the matured dolphin the dorsal ribs (five) that reach the sternum, were retained in natural articulation, to set at rest the exact positions of the tubercula and capitula in each pair of ribs. It is an excellent plan to keep at least one such thorax in every comparative collection as it forms a court of appeal when cetacean skeletons are in process of mounting.

External Measurements

Name of Measurement	Adult Male		Immature Male	
	Feet	Inches	Feet	Inches
Total length between vertical rods	8	1	6	5
Girth at dorsal fin	3	8	No	data
Width of tail	1	9½	1	3
Tip of beak to constriction	0	6	0	6
Size of the eye	0	1¼ x ¾	0	1¼ x ¾
Length of pectoral fin along a middle line ...	0	8½	0	8
Height of dorsal fin	0	8½	0	8

During the dissection of these two animals various data were collected that are of greater individual than general utility, and they are therefore not detailed in the present text. By way of giving a comprehensive survey of the skull characters, available to us, a large comparative table has been drawn up and is hereunder appended. Two young dolphins in the collection of the Hobart Museum, which measure four feet two, and four feet four respectively, are available to us. They were captured in the Derwent, and prepared by Mr. Arnold of the Museum Staff. Mounted specimens are notoriously untrustworthy, as to outline, but a curious mobility of the snout from the constriction upwards suggests an outline that is actually approached in life when dolphins are racing at full speed through the water. It is, as far as our observations go, a prelude to a thoracic flexure, and a distinct shiver can be seen to run from stem to stern of this living ship—and then follows the enormous caudal effort that completes the action. The head and thorax of a dolphin are less immobile than is commonly supposed, and cephalic, thoracic, and caudal flexures can be distinctly observed, in clear sunlit seas, when dolphins in sportive mood are swimming around a ship. (Plate II.)

COMPARATIVE SKULLS OF DOLPHINS. *(Delphinus delphis.)*

nen Number ... RSHIP	No. 1 HOBART MUSEUM.	No. 2 LAUNCESTON MUSEUM.	No. 3 LAUNCESTON MUSEUM.	No 4 HOBART MUSEUM.	No. 5 LAUNCESTON MUSEUM.	No. 6 LAUNCESTON MUSEUM.	No. 7 LAUNCESTON MUSEUM.	No. 8 HOBART MUSEUM.	No. 9 LAUNCESTON MUSEUM.
of skeleton avail-	Complete skeleton ♂ called "*D. fosteri.*"	Skull only. ♂ Imperfect.	Skull only. ♂ Imperfect.	Skull only. ♂ Reg. 4680.	Skeleton Adult. ♂ Mature.	Skull only. ♂ Mature.	Skeleton Immature. ♂	Skull only. Mature ♀ Reg. 4425.	Skull only. Mature ♀
of the bone and ısurement made ...	Skull.	Skull.	Skull.	Skull	Skull.	Skull.	Skull.	Skull.	Skull.
length without ndible	464 mm. (18¼ in.)	460 mm. (18⅛ in.)	462 mm. * (18 3/16 in.	440 to 445 mm. (17½ in.) *	483 mm. (19 in.)	457 mm. * (17 7/16 in.)	443 mm. (15 5/16 in.)	437 mm. (17 3/16 in.)	448 mm. (17⅝ in.)
with mandible ..	470 mm. (18½ in.)	No Mandible.	No Mandible.	450 mm. (17 11/16 in.)	515 mm. (19⅞ in.)	No Mandible.	449 mm. (17⅝ in.)	441 mm. (17⅜ in.)	No Mandible.
ible alone ...	395 mm. (15½ in.)	No Mandible.	No Mandible.	382 mm. (15 in.)	427 mm. (16 13/16 in.)	No Mandible.	378 mm. (14⅞ in.)	370 mm. (14½ in)	No Mandible.
,est skull width at ı zygomatic arch ...	188 mm. (7⅜ in.)	185 mm. (7¼ in)	190 mm. (7 7/16 in.)	189 mm. (7⅜ in.)	202 mm. (7 15/16 in.)	186 mm. (7 5/16 in.)	183 mm. (7 3/16 in)	193 mm. (7 9/16 in.)	192 mm. (7½ in.)
ı to end of beak ...	290 mm. (11⅜ in.)	287 mm. * (11¼ in.)	285 mm. (11 3/16 in.)	274 mm. * (10¾ in.)	288 mm. * (11 5/16 in.)	286 mm. * (11 3/16 full.)	278 mm. (11⅞ full.)	274 mm. (10¾ in.)	No data.
width at the notch	90 mm. (3½ in.)	95 mm. (3 11/16 in.)	104 mm. (4 1/16 in.)	90 mm. (3½ in.)	100 mm. (3⅞ full.)	90 mm. (3½ in.)	89 mm. (3 7/16 in.)	100 mm. (3⅞ full.)	98 mm. (3 13/16 in.)
h in the middle of › beak	54 mm (2⅛ in.)	56 mm. * (2 3/16 in.)	55 mm. (2 5/32 in.)	52 mm. (2 1/32 in.)	70 mm. (2¾ in.)	55 mm. (2 5/32 in.)	52 mm. (2 1/32 in)	57 mm. (2¼ in.)	56 mm. (2 3/16 in.)
ıt at vertex with ndible, if available	152 mm. (5 31/32 in.)	148 mm. (5 13/16 in.)	150 mm. Mutilated. (5⅞ full.)	155 mm. (6 1/16 in.)	168 mm. (6 9/16 in.)	152 mm. (5 31/32 in.)	150 mm. (5⅞ full)	152 mm. (5 31/32 in.)	149 mm.* (5⅞ in.)
ɩest width of pre- rial basin	69 mm. (2 11/16 in.)	68 mm. (2⅝ full.)	69 mm. (2 11/16 in.)	70 mm. (2¾ in.)	74 mm. (2⅞ full.)	70 mm. (2¾ in.)	69 mm. (2 11/16 in.)	75 mm. (2 15/16 in.)	76 mm. (3 in.)
lity and Donor ...		N.W. Coast of Tasmania (per Mr. M. T. Cheek).	Tamar Heads (Mr. Adye Douglas).		Scamander (per Mr. J. G. Walker).	King Island (per Mr. J. M Bowling).	River Derwent (per Mr. J. V. Cook).		Kelso—Tam Heads (per Rev. W. Whit
notes	Fair order. (Plate III.)	* Mutilated.	* Mutilated.	* Mutilated. (Plate IV.)	* Mutilated during life by a Killer.	* Mutilated.	Good order.	Good order. (Plate V.)	* Mutilated

DESCRIPTIVE AND GENERAL.

No. 1.—This skull is practically adult, but shows no super ossification. The ra-occipital hood overhangs the frontals. The vomer is extremely thin (as it ears in the palate, for 60 mm.). Rostral cartilage not ossified. Left nasal sends 'n a short process. Sutures not ankylosed to extinction in temporal fossæ, at vertex, *or the otocrane.* Interparietal coalesced with the frontal and the ra-occipital. General build of skull might suggest a sub-race, if external racters supported the idea. T. M. No. D 590. (Plate III.)

No. 2.—This is a beach-worn specimen, more adult than No. 1. Sutures ned by exposure to the weather, much mutilated at the end of the beak. Left al fused to the pre-frontal, supra-occipital hood rubbed but apparently similar No. 1. Beak of notch wider than No. 1 but less than the female skulls manifest.

No. 3.—Typically an adult male. This is also a beach-worn specimen. All racters conform to the type.

No. 4.—Adult, but showing no super ossification. Owing to method of cleaning minute osteological details are available. (Plate IV.)

No. 5.—Fully adult, with all the super ossification ever shown by the Dolphins this genus. The mandibular excess (in length) is due to the upper jaw being mutilated during a fight in early life. The effect was that of upturning the of the beak, the bones being cross penetrated by a healed wound. This anim was eight feet one inch long.

No. 6.—Skull found at Surprise Bay, King Island. It to all intents and p poses duplicates specimen No. 1, and is therefore of the sub-race called "*Delphi fosteri.*"

No. 7.—A fine specimen of an immature male, all the characters of the mal type are present. The various stages of skeletal growth and developm may be studied in this specimen. Total length of the animal, prior to dissecti six feet five inches.

No. 8.—Fully adult female, a typical sex specimen. Prenarial basin shal and wide. Intermaxillæ subside upon the maxillæ less steeply than in the m Mandible shorter than that of the male. (Plate V.)

No. 9.—Typical female skull, sawn through for study of the falx. No n dible. All female characters splendidly shown as *vide supra*, in contrast w No. 8, a female, and No. 1, a male.

The Skeleton.

The axis and atlas vertebræ are always ankylosed in these whales, the rest of the cervicals being quite free. The vertebral formula is fairly constant, and may be given as follows:—

Cervicals = 7.
Dorsals = 14 (some cetologists say 15).
Lumbars = 22.
Caudals = 32 = 75—with a maximum of 76.

Accidental mutilations of the vertebræ are common, even among young animals, owing to the custom of diving under ships in rapid motion. Such effects usually manifest themselves in the shape of exostosis, which may either simply cover the elements involved, or by partial absorption and subsequent accretion, materially alter the contour of the bones. We hold various instances, in our respective collections, of these naturally healed wounds. The true lumbar vertebræ are devoid of zygapophyses, but they appear in a functionally reduced state on the chevron-bearing portion of the caudal series, having doubtless reference to muscular attachment areas rather than anything else. The neural spines slope gradually backwards through half of the dorsal series, assume a recovery in the second half, and become vertical in the middle of the lumbar series—approximately the twenty-eighth vertebra from the skull. The chevron-bearing series (or as we might call them sacro-lumbars, although usually simply included in the caudal series) begin by being approximately vertical, as regards their neural spines, and end by having them pitched at a slope that closely simulates that which obtains in the middle dorsals. In the two animals dissected by me, the following express the sizes of the neural spines, and neurapophyses of the last dorsal that reaches the sternum, and the largest lumbar of the series; in other words—the twelfth and twenty-eighth vertebræ, from the skull.

Comparative Vertebræ.

Adult Male	Name of Vertebra	Measurement made	Size in mm.	Immature Male	Size in mm.	Remarks
"	No. 12 from the skull	Upper surface of centrum to tip of spine	70 mm.	"	65 mm.	Epiphyses of immature animal all open
"	No. 28 from the skull	Upper surface of centrum to tip of spine	117 mm.	"	100 mm.	Epiphyses of immature animal all open

Comparative Arm Bones.

Adult Male	Measurement made	Size in mm.	Immature Male	Size in mm.	Remarks
"	Humerus, alone	60 mm.	"	55 mm.	In the immature animal the epiphyses are all open
"	Total length of humerus, radius, wrist, and fingers	330 mm	"	250 mm.	

Measurement applied comparatively to two animals in different stages of growth does not, always, convey to the mind the real differences existing between their skeletons —and in this connection weight is often a most useful aid. The outline of a bone may be very close to the size attained at maturity, and yet the amount of ossific matter deposited in that bone may be far below the quantity found in a similar bone taken from a fully matured animal. The humerus of the adult male dolphin, above cited, turns the scale at 55 grammes, while the same bone from the arm of the immature animal only weighs 28 grammes! This expresses more fully the real skeletal departure, than the minus of five mm. does, upon total (comparative) length. Comparative weights often reveal startling differences in skulls that upon measurement alone would be relegated to the common standard of "at, or about the same age." Naturally the general condition of the skull has to be carefully considered, and the weight standard is only absolutely a test when both specimens weighed have been treated exactly the same throughout, as in the present instance, with the humeri, where both were cleaned and dried under a common series of conditions.

Ear Bones.

The ear bones of immature dolphins of over two thirds the adult, minimum age of maturity, are practically as highly developed as those of their seniors—which means, that these atrophied sense capsules grow little, or not at all, after the period named. Ear bones of males, and females, manifest individual, and it may yet be shown sex variations, that would be called into determinative requisition if found fossil. An extensive range of specimens all correctly sexed, and aged, would yield some interesting data here. Ear bones of the genus *Delphinus*, can be separated from those of *Globicephalus*, by the less production of the tympanic, at its anterior articular end. Again, they can be separated from the Beaked whales, of

the genus *Mesoplodon*, as can those of *Tursiops*, and *Globicephalus*, by the less production of the posterior articular end of the perotic. In this connection *Tursiops* is intermediate, showing a more or less style-like extension that cuts it off from ear bones of either *Delphinus*, or *Globicephalus*. *Mesoplodon*, however, of all the whales named, is, at the point indicated, both extended and truncated. Minor variations of the foramina, etc., are not easily detailed in anything but an illustrated monograph, although interesting enough to the student.

DESCRIPTION OF PLATES.

Plate I.

This shows a photograph of Maingon Bay, Tasman's Peninsula, with Cape Raoul in the distance. In the foreground can be seen the dolphins springing out of the wave as it broke upon the shore. While this gives some idea of the scene, it does not convey any idea of the number of dolphins in the bay, or the number that could often be seen in the surf at one time. Owing to the very dull light, and the great rapidity with which the animals performed their aquatic evolutions, it was exceedingly difficult to obtain a photograph of the event. Of the many photographs, those taken by Mr. F. B. Cane give the best effect, and we have to thank him for allowing us to use them to illustrate these notes.

Plate II.

Two young dolphins captured in the River Derwent. The irregularity of outline is due to the mounting. (Tasmanian Museum, Reg. Nos. D591 and 592.)

Plate III.

Articulated Skeleton of *Delphinus delphis* (*fosteri?*) (Tasmanian Museum, Reg. No. D590.).

Plate IV.

Skull of *Delphinus delphis*.
(Tasmanian Museum, Reg. No. 4680.).

Plate V.

Skull of *Delphinus delphis*.
(Tasmanian Museum, Reg. No. 4425.).

STUDIES IN TASMANIAN MAMMALS, LIVING AND EXTINCT.

Number I.

Nototherium mitchelli.

(A Marsupial Rhinoceros.)

Nototherium mitchelli, Owen, British Association for Advancement of Science, Report 1844, p. 232.

?*Zygomaturus trilobus*, De Vis, Proceedings Royal Society of Queensland, 1888, Vol. V., pt. 3, p. 111.

By H. H. Scott (Curator, Launceston Museum); and
Clive E. Lord (Curator, Tasmanian Museum).

(Received 3rd May, 1920. Read 10th May, 1920.)

The discovery at Smithton, during the present year, of a nearly complete skeleton of *Nototherium mitchelli* forms the occasion for a revision of many of our ideas respecting these remarkable marsupial animals, since the fragmentary remains hitherto available for study have failed to yield the sequence of evidence we now possess. This is a note only—intended to place upon record the fact that *Nototherium mitchelli* was an extinct marsupial rhinoceros, and that the four genera, *Nototherium*, *Zygomaturus*, *Euowenia*, and *Sthenomerus*, with their several species, are accordingly under revision—and will later on be dealt with in detail. The enormous mass of material to be passed in review forbids anything like speculation at present, but it is within the mark to observe that two groups of these animals have been instinctively felt (by all workers) to have existed, quite irrespective of sex questions—one a platyrhine and the other a latifrons type, and that it now appears that they were also a horned, and a hornless group, and that *Nototherium mitchelli* belonged to the former, or cerathine group, and that some other species constituted the acerathine group, in which the

weapons were reduced to very small things, or actually missing. We are fully alive to the fact that the sex question comes strongly to the front here, and we hope to fully deal with the whole question later on. The true Rhinoceroses and Tapirs had generalized ancestors that brought these two families exceedingly close together, and so closely did they simulate each other that the teeth alone served to distinguish them. The *Nototheria* had tapir like teeth, and, as Professor Owen demonstrated, as far back as 1872, the nasal structure recalled the anatomy of the Tichorhine Rhinoceros, but with the imperfect material Owen had to work upon he was unable to say, as we can to-day, that *Nototherium mitchelli* was a marsupial Rhinoceros, and not a marsupial Tapir like animal, as hitherto assumed. The fortunate discovery of remains of the Tichorhine Rhinoceros, embedded in the ice, enabled palæontologists to speak with absolute certainty as to the nature of the animal's horn, but the absence of such an event in our case leaves grounds for conjecture as to structure and shape, to which set of circumstances we must add the fact that the marsupials, as a group, are well removed from the ancestral rhinoceros type, and accordingly the complex factors of "parallel evolution" have to be contended with. At present all that can be said is that we have an animal with a skull built for aggressive warfare with specially constructed cervical vertebræ—powerful and shock resisting—nasal regions akin to those of the Tichorhine Rhinoceros, plus a curious nasal cartilage point (practically unique), which is evidently a development, essential to the remoulding of the marsupial skull, to the special needs of the case. All these structures will, in due course, be dealt with, but at present can only be glanced at. Evidence of the titanic battles that this animal engaged in are to be found in the complete smashing and partial mending of the collar bone, the crushing in of the maxills-nasal region, and its subsequent repair. The whole series of structures that in *Nototherium tasmanicum* could have served no greater purpose than a moderate resistance of force, are here, in *Nototherium mitchelli*, built up to the strength essential to the conducting of the fiercest aggressive warfare; and the conclusion seems inevitable that the Marsupial Order, in ages past, evolved a fighting group of Rhinoceros like animals, of which the giant, *Nototherium mitchelli*, was one. The Palæontologist De Vis worked hard to show that *Zygomaturus* was a rare animal in its day, and made many departures from the typical *Nototheria*, thus feeling his way through fragmentary evidence to a segregation of the two groups cited above. Professor Owen never saw

the skull called *Zygomaturus*, but claimed a cast of it, as a replica of the skull that should have been associated with the type jaws of his genus *Nototherium*. We hold a very exact copy of Professor Owen's cast, and have checked it with his description and measurements, and found it to agree *in toto*, but the real skull, that has come to us, is more powerful in the essential parts, and accentuates the Rhinoceros habits in a most marked degree. In working over this cast, with Professor Owen's descriptive text as a guide, the master mind of the great comparative anatomist stands boldly out, and the pity is Owen is not here to deal with this splendid find from the Tasmanian pleistocene formations. This latest addition to our knowledge shows that the cerathine *Nototheria* were much larger animals than the genus were suspected of producing, and we quite expect to find Huxley's *Diprotodon minor* thus accounted for, not so much for its original description as for its later acceptance by others, who, finding Nototherian remains relating to the appendicular skeleton, naturally relegated them to *Diprotodon minor*, but this question we shall deal with very fully later.

STUDIES IN TASMANIAN MAMMALS, LIVING AND EXTINCT.

Number II.

Section 1.

The History of the Genus *Nototherium*.

Section 2.

The Osteology of the Cervical Vertebræ of *Nototherium mitchelli*.

By

H. H. SCOTT (Curator of the Launceston Museum)

and

CLIVE E. LORD (Curator of the Tasmanian Museum).

Plates VI. and VII.

(Read 8th June, 1920.)

SECTION 1.

THE HISTORY OF THE GENUS *NOTOTHERIUM*.

In the middle of last century the first fossil remains of the extinct gigantic marsupial fauna of Australia were discovered. Although subsequent discoveries gave rise to the opinion that their distribution must have been a wide one, it was not until the year 1910 the first remains of these animals were discovered in Tasmania. This, and subsequent discoveries in the island, have all been of the one genus—*Nototherium*—but there appears to be no valid reason why the discovery of the remains of such marsupials as *Diprotodon* and *Thylacoleo* may not be anticipated. This view is strengthened by the fact that the species recently obtained at Smithton is *Nototherium mitchelli*, the typical mainland form, and not *N. tasmanicum*, which, up to the present, has only been discovered in this island. The discovery is also another link in the chain of evidence, showing that the subsidence of Bass Strait must have been of quite recent date—geologically considered.

In continuation of our previous note on the discovery of an almost complete skeleton of *Nototherium mitchelli* (1) we propose to review briefly the history of the genus. This is essential in order that our facts may be presented in a clear light. Incidentally, it will be necessary to deal with the various side issues which arose as *Nototherian* remains were slowly recovered from the Pleistocene formations of Australia, and eventually Tasmania also.

On 13th April, 1831, a paper (dated at Sydney, 14th October, 1830) was read before the Geological Society of London (2). It was entitled, "An account of the lime-"stone caves at Wellington Valley, and of the situation "near one of them, where fossil bones have been found," by Major Thomas L. Mitchell, F.G.S., J.C., Surveyor General of New South Wales.

In this description it is pointed out that the Wellington Valley is 170 miles west of Newcastle, on the eastern coast of Australia. The rock through which the valley has been excavated was limestone, resembling, in external characters, the carboniferous series of Europe. The rugged surface of the limestone tract abounded in cavities. One large cave descends at first with moderate inclination, and at about 125 feet from the mouth the floor is thickly covered with fine, dry, reddish dust, in which a few fragments of bones occur. About eighty feet from the mouth of the cave is another cavity. Here the surface itself consists of a breccia full of the fragments of bones. Near the lower part of the fissure (the whole extent of which was not explored), were three layers of stalagmitic concretion about two inches in thickness and three inches apart, the spaces being occupied with a red ochreous matter, with bones in abundance imbedded both in stalagmite, and between the layers of it. In describing the bones it was stated that the bones, with two exceptions, belong to animals at present known to exist in the country. "Along with the remains just mentioned "were found two bones, not agreeing with those of any of "the animals at present known to exist in New South "Wales. The first, and larger, is supposed to belong to the "elephant. The second bone is also obscure and imper-"fect, but seems to be a part of one of the superior "maxillary bones of an animal resembling the Dugong; "it contains portion of a straight tusk pointing directly "forward."

In 1838 Mitchell published his work on "Three Expeditions into the interior of Australia (3). The issue we have been able to refer to is a copy of the second edition, published in 1839. Commencing at page 359, in Vol. II.,

he gives an account of a detailed examination of the Wellington Valley Caves, together with geological maps and sketch sections. He states that the particulars concerning the animal remains referred to in his paper read before the Geological Society, had derived great additional importance from the discoveries made by Professor Owen.

Several plates were included, by Mitchell, in order to illustrate the bones. as well as a letter from Professor Owen. In the epistle, headed "The Royal College of "Surgeons, May 8th, 1838," the Professor stated, *inter alia,* "Genus Diprotodon. I apply this name to the genus "of Mammalia, represented by the anterior extremity of the "right ramus, lower jaw, with a single large procumbent "incisor. . . This is the specimen conjectured to belong "to the Dugong, but the incisor resembles the corres- "ponding tooth of the wombat in its enamelled struc- "ture and position. . . But it differs in the quadrilateral "figure of its transverse section, in which it corresponds "with the inferior incisors of the hippopotamus."

Strictly speaking, of course, this related to the genus Diprotodon, rather than to Nototherium, but as we hope to deal with the question of the *Nototheria* in relation to geological time at a later portion of this historical series, the remarks of Mr. (afterwards Sir) Thomas Mitchell are of interest. It also explains the inception of Mitchell's connection with Palæontology. He was of opinion that the caves had been probably twice immersed, and that in general the plains of the interior had been under the sea at one time. The accumulation of animal remains were very much broken. No entire skeleton was discovered, and very rarely were any two bones of the same animal found associated.

In the Report of the British Association for 1844 (4) appears the first reference to *Nototherium* * as distinct from *Diprotodon*; Professor Owen making two species from the material that was available to him at the time—the first of these being *Nototherium inerme*, and the second *N. mitchelli.* The collection available to the learned Professor was not large. It came from the Condamine River, and was collected by Sir Thomas Mitchell, C.B., who appears to have taken a keen interest in the collection of such fossils as these. From the study of the available data, the genus was founded in the belief that these animals, unlike the *Diprotodon*, had no tusks. The mistake was due to the lack of sufficient material, and also to the mutilated character of the specimens used as the types.

In 1845 Professor Owen received from Leichhardt and Boyd the mandibular ramus of a young *Nototherium*, showing the germ of an incisor (5) together with other specimens. The inclusion of the incisive tusks necessitated a revision of the genus. This was the first emendation of the type.

In 1856 the first skull was discovered that could be relegated to this genus; it came from the Darling Downs, and was minus the mandible. Mr. W. S. Macleay, of the Australian Museum, named this skull *Zygomaturus trilobus*, in a popular report of the discovery contributed to the local press during August, 1857.

Professor Owen protested against the new classification, and eventually a cast of the skull and photographs, giving details, reached him. The cast came later than the photographs, so that we can omit the report upon the former, and bring the matter down to 15th June, 1871, when Professor Owen's real work upon the cast was read before the Zoological Society, constituting Part V. of his series upon the Fossil Mammals of Australia. In this monograph he recapitulated all the published facts, claimed that the skull from which the cast was made was that of *Nototherium mitchelli*, and that, *ipso facto*, *Zygomaturus trilobus* was eliminated. As a consequence, the latter designation was allowed to lapse until Mr. C. W. De Vis, M.A., of Queensland, elevated it to the rank of a genus. De Vis' work in this connection will be considered later. In the year 1877, Owen published his paper on the Extinct Fossil Mammals of Australia in two quarto volumes, adding some notes to the genus Nototherium, and giving a woodcut of a humerus (Pl. CXXVII.), which he felt justified in relegating to this genus. The humerus really had nothing whatever to do with the genus *Nototherium*, but its resemblance to the same bone in *Phascolomys*, served to link it to the Phascolomyidæ in all classifications from that day until 1910, when the real humerus was discovered in Tasmania (6), together with the rest of a skeleton (*N. tasmanicum*), thus settling the matter at rest once and for all. One effect of this incorrect relegation was that any robust *Nototherian* humeri that were found were naturally relegated to *Diprotodon minor*, a species founded by Professor Huxley in 1862 (7). The late Dr. Stirling, F.R.S., of South Australia, was a strong supporter of Huxley's species, *D. minor*, but, with the coming to light of the true *Nototherian* humerus, felt the wisdom of going through the South Australian fossil humeri provisionally related to that species, but his attention being fully

claimed by Ethnological Studies, he never again published upon the question.

In 1882 Professor Owen described (8) a distal end of a femur which he thought might belong to the Genus *Nototherium*; this also—in 1910—was shown to be incorrect, and we may assume that some of the changes rung by taxonomists upon the *Nototherian* remains discovered from time to time, found support upon the departure of the real femur from that incorrectly relegated to it, the more so as the real femur is exceedingly similar in outline to that of *Diprotodon*.

This practically ends Professor Owen's connection with the genus.

In the year 1874, Professor Frederick McCoy, of the Melbourne University, figured (9) some *Nototherian* tusks (from Back Creek, Victoria), in a comprehensive study of *Diprotodon* and *Nototherian* dentition.

The next important developments of the generic history of this species were due to Mr. C. W. De Vis, M.A. who first relegated a humerus to *Nototherium* that departed so much from Owen's specimen that Lydekker, in his British Museum Catalogue (10), published in 1877, relegated it to *Diprotodon*, without question, but it is to-day, on the face of it, apparent that De Vis was correct in this matter.

Later on, in August, 1887, De Vis created a new genus for extinct *Nototherian* animals, calling it *Owenia*, which was later changed to *Euowenia*; this was communicated to the Royal Society of Queensland (11), the material being a skull and mandible, and the specimens were much crushed. Some of our own controversial material—yet to be presented—will revolve around this, and De Vis' subsequent taxonomic efforts at reconstruction.

In December of the same year (1877), he contributed a paper to the Linnean Society of New South Wales (12), making a new species of *Nototherium*, namely, that of *Dunense*.

By far the most important addition to the literature of this subject added by De Vis was a paper published in 1891 (13), in which, while confirming and re-naming the genus *Owenia*, he suggested a complete revision of the taxonomy of three extinct animals. This opens up several questions, and must be dealt with in some detail, as it recapitulated all published data, and questioned the correctness of even type specimens and their subsequent as-

sociations with more perfect specimens. De Vis' contentions may be summed up as follows:—

1. The skull claimed by Owen was not the correct cranium of *Nototherium* at all, and still stood generically distinct under the name of *Zygomaturus*, with characters duly detailed.
2. That Lydekker's creation of a family *Diprotodontidæ* was unwise, and that the only family that really existed was that of *Nototheriidæ*, of which *Diprotodon* was a genus.
3. That the family just named included the following genera:—

NOTOTHERIIDÆ

Dentition:

General characters: Posterior upper incisors small. Premolars, except in *Zygomaturus*, subtriangular, unicuspid; with a posterior talon. Molars transversely bilobed, the upper without longitudinal ridges, talons anterior-posteriorly narrow. Scapula long and narrow. Ilia greatly expanded. Limbs gressorial, approximately equal; their proximal bones elongate, simple. Foot broad, tail short, tapering.

Synopsis of Genera.

Nototherium.

Incisors: Upper premolars subtriangular, unicuspid; cranial habit and length of muzzle moderate. Crowns of first incisors contiguous, or slightly diverging, the lower incisors proclivous. Posterior upper incisors on the edge of the jaw; cusp of premolar with a shallow posterior cleft.

Diprotodon.

Posterior upper incisors near middle line of the jaw; cusp of the premolar with a deep lateral cleft.

Zygomaturus.

Upper premolar oval, tuberculated; cranial habit very massive, with short expanded muzzle

Euowenia.

Incisors: Crowns of first incisors above and below widely diverging, with a similar strong double curvature.

Some parts of the above contention had been published by De Vis prior to the extenso notes given above, and the late Richard Lydekker (14) answered it, taking up the following ground: That the cast used by Professor Owen showed that the two premolars were not the same, one at least agreeing with the very class of tooth that De Vis had accredited to the genus *Nototherium*, and that apparently the other tooth did not belong to the original skull from which the cast was made. We hold a copy of this cast, and the two premolars agree with Lydekker's statement, but for the present we pass this item over. In 1894 De Vis described (15) a mandible of *Zygomaturus*, and with some warmth defended his position, again claiming that only a single family existed, namely, *Nototheriidæ*, and that *Zygomaturus* was a genus of that family.

The year 1911 brought out a description of the humerus, and parts of the skull of *Nototherium tasmanicum* in "The Tasmanian Naturalist," by Messrs. H. H. Scott and K. M. Harrisson (16). In 1912 saw the description of *Nototherian* teeth (17), by L. Glauert, F.G.S., from specimens found in Western Australia, in which *Zygomaturus* was claimed as a synonym of *N. mitchelli.*

The same year some teeth from King Island gave evidence of Professor Owen's *Nototherium victoriæ*, being more than a mere individual variation of the type *N. mitchelli*, and later on a monograph on *Nototherium tasmanicum* was published by the Geological Survey of Tasmania (18). In the latter, the author (H. H. Scott) claimed *Zygomaturus* as a sex mystery, and suggested that as a working hypothesis, all weak and flat-tusked animals be regarded as females, the stouter tusked animals be called the males.

The discovery, in 1920, of a very perfect skull, and most of the skeleton of a large *Nototherium* at Smithton, by Mr. E. C. Lovell—taken in conjunction with the former discovery of a skeleton in 1910—gives such an opportunity for a revision of the above that we propose to review the whole question in detail. This latter can only be effectively undertaken after the osteological data have been presented, so for the present we content ourselves with the statement that having proved that the mandible from the Boyd Collection (Brit. Mus. Coll.

32050) is identical with the jaws of *Zygomaturus*, Owen's determination of *Nototherium* as a genus stands good, and De Vis' dissensions rule out. At the same time, the evidence to date of writing tends to show that the real position is this:—

1. That the mandible from the Boyd's Collection, of which we hold an accurate cast, came from a male animal, and that the first *Zygomaturus* skull (and, therefore, Owen's cast, Brit. Mus. Coll. 33259) was a female.

2 Owen's so-called "female" jaws, we will deal with later, just recalling as we pass along that Owen made this determination with a strong reservation, and published his note with a query appended to it.

3. That De Vis afterwards obtained male skulls of his so-called "*Zygomaturus*" which depart—in sex variation—rather strongly from those of the female, and that in the circumstances the position he took up is readily understood. In going over this matter it is also evident that De Vis' contentions did good work, and are even now assisting to solve the problem of these ancient giant marsupials.

4. If the Boyd's collection mandible is placed side by side with the mandible of the latest discovery from Smithton, they will be found to agree *in toto*, while the skull itself agrees exactly with De Vis' determination of *Zygomaturus*, and departs from Owen's cast in exactly the way De Vis claimed.

5. Being practically certain (evidence yet to be given) that our animal was a male, the sex differences square all other outstanding points between Owen and De Vis—and *Zygomaturus*, as reconstructed by the latter, becomes a sex variation, and not a taxonomic one.

SECTION 2.

THE OSTEOLOGY OF *THE CERVICAL VERTEBRÆ.*

As we duly point out in our published (19) introductory note, the cervical vertebræ of *Nototherium mitchelli* are of special morphological interest, combining in fact

the maximum of strength with the minimum of bulk and weight. The especial features are these:—

1. The vertebræ are thin and wide, with enormous pre and post zygapophyses.
2. The centra are transversely oblong, thus giving an enormous neural canal—since the neurapophyses are so spaced as to embrace the whole area thus yielded.
3. The intervertebral pads were reduced to the smallest possible thickness, and accordingly the long zygapophyses functioned strongly.
4. The neural spine of the atlas (when the neck muscles were all in action) blocked against the spine of the axis, thus converting the whole series into a practically solid mass, and broke the shock of the act of ramming a foe. The remaining features will be detailed *in extenso*.

The lower border of the atlas is not completed by a bony bar below, the space being equal to 30 mm. The top of the neural canal, which in antero-posterior extent equals 30 mm., is still marked by the reticulations of the *dura mater*, indicating the perfect preservation of the bone. Both neurapophyses are perforated by a foramen, set in a deep channel (that girdles the rims of the anterior condylar cups) leading backwards and outwards to the incomplete inter-vertebral artereal foramen, thus obviously tracing the course of that artery.

Below the first-named foramina, and therefore between the occipito-axian articular cups, are two large scars some 15 mm. in diameter for the attachment of the great transverse ligament, essential to the setting of the odontoid process of the axis. Across that process runs a deep groove, also 15 mm. wide, marking the passage of the ligamentous band, and its synovial sac. The rest of the internal atlantean, neural, area is roughened by the attachment of capsular ligaments. The incompletion of the atlantean bony ring leaves room for conjecture as to muscular and ligamentous dispositions in this area, for the roughened apex of the odontoid process demands a strong central odontoid ligament. The spine of the atlas—whose unique function has already been cited—is divided into two areas, one that fits the axian spine, and an anterior muscular attachment surface apparently for powerful rectus capitis homologues. The crowding out from this area of any fascia

of the ligamentum nuchæ, as is usual among animals with heads carried horizontally, left this part of the spine free for the needs of the special adaptation that we find to obtain. Some kind of pad must have existed between these two spines, either muscular, cartilaginous, or ligamentous, but in the macerated bones the slightest compression of the cervical series, as a whole, jams the two spines firmly together. This special adaptation is, as far as we know, unique. In a monograph upon *Nototherium tasmanicum*, this action of the two anterior cervical spines in Nototheria was noted in the following terms:—"During "normal vertebral articulation, the aborted spine of the "atlas worked against this point in the axis, both being "flattened and roughened, as if for a loose kind of syndes-"mosal union." (20)

The posterior edges of the atlantean neurapophyses are groove-scarred for 35 mm. on either side, to receive interspinalis muscles, and ligaments that filled a fossa in the atlas 40 mm. wide x 40 mm. high; indeed, the whole under portion of that spine is thus excavated. This bold excavation of the neurapophyses continues throughout the cervical series, and when the seventh is reached, in spite of its apparent thinness, it yet yields a muscular and ligamentous attachment fossa, 70 mm. wide and 20 mm. deep.

This enormous padding of muscles and ligaments, added to the great strength of the zygapophyses, enabled what would otherwise be a weak neck to withstand enormous shocks, and was a special evolution of the marsupial skeleton. To give stress to this point it may just be added that the fourth cervical is only 34 mm. thick, measured through the centrum, but the processes for interlocking bring its total up to 65 mm.

The vertebra-artereal foramina are completed by bone in the third and subsequent vertebræ; are nearly completed in the axis, and indicated only in the atlas; the sizes of these are given in the table of measurements appended hereto. In the specimen under examination, the right diapophyses is complete and the left nearly so, the former enabling us to say that the muscular attachments were all of a very extensive character. Skullwards the homologue of the rectus capitis lateralis, and the superior oblique claimed large areas, while the scar upon the back of the process evidently related to a moiety of the levator anguli scapulæ. The similarity of such muscles as the latter, with those of man, related in part at least to the complete revolution of the arm in mar-

supials incidental to the manipulation of the pouch. On the other hand, the likeness ends when we come to deal with the ligamentum nuchæ, which in such animals as are here under consideration, require an elastic ligament of great length and power, together with freedom of the two anterior vertebræ. Accordingly, the ligamentum nuchæ may arise far down upon the lumbar region, fan out upon the first dorsal spine into two fascia, one of which rains down upon the five posterior cervical spines, and the other ascends to the occipital regions for insertion. In this *Nototherian* skull, the supra-occipital bone is deeply excavated by two fossæ to receive this important ligament, a low median bony bar acting as a central septum, the total area thus occupied by the fossæ is 125 mm. wide, and apparently 100 mm. in vertical extent.

A common occipito-cervical ligament, modified in the anterior spinal regions, must have existed, and other myological notes could no doubt be collected, but the above data chiefly interest us in the present study.

COMPARATIVE CERVICAL VERTEBRÆ. *Nototherium mitchelli* (No. 1). *Nototherium tasmanicum* (No. 2).

Name.	Height.	Width.	Diameter anterior centrum.	Height of neural canal anterior.	Width of neural canal anterior.	Across rims of articular cups of atlas	Greatest length of Transverse processes.	Length of zygapophyses (platforms).	Antero-posterior length of spine of axis.
Atlas									
No. 1	100 mm.	212 mm.	No centrum	No. 1, 77 mm	No. 1, 56 mm.	125 mm.	73 mm.	37 mm.	65 mm.
No. 2	95 mm	230 mm.		No. 2, 58 mm.	No. 2, 56 mm.	113 mm.	70 mm.	35 mm.	45 mm.
						Vertebra arterial foramen			
Axis	Mutilated								
No. 1	134 mm.	144 mm.	100 x 50 mm.	30 mm.	46 mm.	No. 1, 21 x 15	No. 1, 47 mm.	No. 1, 39 mm.	—
No. 2	157 mm.	126 mm.	95 x 40 mm.	20 mm.	40 mm.	No. 2, 15 x 15	No. 2, 39 mm.	No. 2, 38 mm.	—
Cervical 3	Mutilated								
No. 1	135 mm.	154 mm.	No. 1 75x47mm	31 mm.	47 mm.	20 x 17 mm.	47 mm.	39 mm.	—
No. 2	150 mm.	140 mm.	No. 2 64x49mm	21 mm.	46 mm.	15 x 15 mm.	39 mm.	35 mm.	—
Cervical 4	Imperfect								
No. 1	144 mm.	171 mm.	73 x 46 mm.	34 mm.	54 mm.	17 x 12 mm.	50 mm.	40 mm.	—
	Imperfect								
No. 2	140 mm	160 mm	70 x 50 mm.	22 mm.	47 mm.	15 x 14 mm.	50 mm.	30 mm.	—
Cervical 5	Spines very								
No. 1	imperfect in	No. 1, 178 mm.	77 x 51 mm.	33 mm.	56 mm.	15 x 15 mm.	56 mm.	42 mm.	—
No. 2	both cases	No. 2, 164 mm.	74 x 51 mm.	25 mm.	55 mm.	15 x 15 mm.	54 mm.	29 mm.	—
Cervical 6		Imperfect					Imperfect		
No. 1	142 mm.	178 mm.	77 mm.	37 mm.	62 mm.	15 x 15 mm.	57 mm.	41 mm.	—
	Imperfect		Imperfect						
No 2	134 mm.	160 mm.	73 mm.	31 mm.	58 mm.	13 x 15 mm.	50 mm.	25 mm.	—
Cervical 7	Imperfect								
No. 1	141 mm.	188 mm.	85 x 58 mm.	41 mm.	70 mm.	17 x 17 mm.	60 mm.	35 mm.	—
	Imperfect								
No. 2	140 mm.	170 mm.	72 x ? mm.*	35 mm.	60 mm.	9 x 7 mm.	45 mm.	24 mm.	—

REMARKS.—Owing to the mutilations to the spines of the Vertebræ of *Nototherium mitchelli*, no comparative measurements have been included in the table. Such data relating to *N. tasmanicum* appeared in the monograph on that specimen

* Centrum imperfect in *N. tasmanicum*.

A study of the comparative table thus supplied will at once make manifest the superior bulk of the vertebræ of *Nototherium mitchelli*, and it only remains to contrast the *Nototherian* vertebræ with a normal marsupial type, to see the extent to which cervical specialisation has taken place.

In the wombat the neck vertebræ are upon the whole similar to those of the *Nototheria*, the neural spine of the axis being wide, with an angular superficial slope of 45 degrees. No special union exists between it and the atlantean spine, and the neurapophyses are not excavated for the implantation of powerful muscles and ligaments. What is true of the first two cervicals is equally true of the whole series, for the interlocking zygapophyses, with the usual supply of interspinalis muscles, and a normally sized ligamentum nuchæ, meet all the needs of the wombat's method of life, but it is otherwise with the *Nototheria*. In weakly horned animals (be they of stirpian or sexual segregation) the wombat cervical conditions are simply carried to a point sufficient to support the weight of the head with, but with small reserves for aggression; the spine (21) of the axis is of the same relative size as that of the wombat, and the neural spines are moderately excavated, thus exactly outlining to us the needs of the non-fighting animals. In *Nototherium mitchelli*, all such structures are carried a stage in advance, and power for power's sake is superadded. To show that this latter statement is not an ungrounded one, it must be remembered that the skull of such an animal as *Nototherium tasmanicum* is as large and weighty as that of *Nototherium mitchelli*, thus furnishing us with the ligamentous and muscular needs for its pose and support, and explaining why the other skull characters of fighting import exist in the skull of *Nototherium mitchelli* at all. When we come to deal with the comparative skulls, we shall have a lot to say upon this matter, it being only necessary to retain for the present the following salient facts in the foreground of our memories:—

1. The skulls of *N. mitchelli* and *N. tasmanicum*—at least—(with a possibility of that of other species) are equally large and weighty, yet their cervical vertebræ show marked differences. One being an exaggeration of the standard of the modern wombat *in about the same ratio of power* (*N. tasmanicum*), while the other shows an additional power with interspinalis muscles and paddings, suitable to the resisting of great shocks in the long axis of the head and vertebræ.

2. The above is an extension of our statement given in the former note to the effect that in an animal like *N. tasmanicum* the structures present could serve no greater purpose than the moderate resistance of force, but in *N. mitchelli* they are built up to a strength essential for conducting the fiercest aggressive warfare.

COULD A NOTOTHERIUM HAVE HORNED A FOE?

In order to establish the fact that a *Nototherium* could have horned its foe, it will be necessary to carry our study of the cervical vertebræ forward to the occiput itself, and pay some attention to the muscular and ligamentous conditions that obtained there. As we are also dealing here with a heavy headed animal whose weapon was planted on the nose, and therefore removed from the neck by a distance of seventeen inches (433 mm.), as against 2 inches (50 mm.) in the case of a modern bull, we must expect to find exceptional conditions provided. A glance at the picture of the neck bones will demonstrate their ability to resist the shock of the act of ramming a foe, and now the study of the occiput proves that the act of violently thrusting upwards the head and revolving it, together with most perfect checks, to avoid dislocation of the neck, were duly provided, as note:—

1. The foramen magnum is transversely oval, 55 mm. in width, and 40 mm. in height, the occipital condyles being very heavy, as might be expected.
   The lower edges of the condyles are excavated by two enormous fossæ for the implantation of the rectus capitis muscles, essential to the uplifting and rotating of the head. These fossæ are 30 mm. long x 12 mm. wide, and would also lodge the atlanto-axoidean ligaments to relieve the muscles from strain, and to enable them to exert their full power.

2. The crest of the magnum foramen carries an extensive transverse attachment tract some 20 mm. long, for the reception of the central odontoid ligament, one of the most important factors to a war-like animal—since any failure of this and the next two ligaments noted would mean death when ramming a foe.

3. The next two surfaces, germane to our subject, are those for the implantation of the lateral odontoid ligaments, since such ligaments are the checks that saved the dislocation of the neck when the animal horned and tossed its foe. In our specimen the surfaces thus provided for are so massive as to simulate a third condyle, and show that the bands of elastic ligament were over 15 mm. wide, and of considerable thickness. If these data are considered in the light of the evidence yielded by the study of the cervical vertebræ—always remembering the fact that the occiput was provided with a ligamentum nuchæ that covered a hundred millimetres of implantation surface—it will be obvious that everything of essential desiderata to a heavy animal wishing to horn its foe is thus provided for. Later on, we shall review the evidence in favour of a horn, figure the skull, and give description of all the cranial features relating to the method of life here assumed to have existed.

EXPLANATION OF PLATES.

Plate VI.

The vertical vertebræ of *Nototherium mitchelli*, showing the powerful zygapophyses and short stunted spine of the atlas, that can be compressed against the heavy spine of axis, during a forceful head thrust, thus converting the neck series into a solid mass of bone, muscle, and elastic ligament.

Plate VII.

To the left is the atlas vertebra. The central bone is the axis, tilted to display the excavation of the neural spine for the reception of interspinalis muscles, etc. To the right, the seventh cervical appears, showing wide neural canal, nature of processes, and excavated neurapophyses for the interspinalis muscles, and the elastic fascia of the ligamentum nuchæ.

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(21) [illegible] 16.

AUSTRALIAN *STRATIOMYIIDÆ.*

By G. H. Hardy.

Plate VIII.

(Read 8th June, 1920.)

Fam. STRATIOMYIIDÆ.

The species belonging to this family are easily recognised by a combination of two venational characters—one is a short discal cell emitting veins, some of which do not as a rule reach the wing border, and the lower branch of the cubital fork running to or above the apex of the wing is the other. The antennæ are of diverse forms, the third joint of which may consist of as many as eight segments clearly defined, or all or many of these segments may be partly or completely fused. The abdomen consisting of from five to seven visible segments is often depressed.

Key to the Subfamilies of the Stratiomyiidæ.

1. The abdomen with seven visible segments. BERIDINÆ.
   The abdomen with five or six visible segments. 2.

2. The wings with three posterior veins. 3.
   The wings with four posterior veins. 4.

3. Antennæ with a short, usually bulbous, third joint which bears a hair-like arista. PACHYGASTERINÆ.
   The antennæ elongate, ten-segmented, the tenth segment as long as the other nine together, ribbon-like, and more or less parallel sided. LOPHATELLINÆ.

4. The wings with the fourth posterior cell rising from the discal cell, or at least touching it. 5.
   The wings with the fourth posterior cell rising from the second basal cell and not touching the discal cell. 6.

5. The scutellum without spines and the last antennal segment elongate. HERMETIINÆ.
   The scutellum with spines and the last antennal segment short or moderately long. CLITELLARINÆ.

6. The antennæ with a thread-like arista. SARGINÆ
   The antennæ without an arista, at most with a short blunt style. STRATIOMYIINÆ.

C

Subfam. Beridinæ.

Synonymy.—In the "*Catalogus Dipterorum*" Kertesz places *Xenomorpha* as a synonym of the genus *Chiromyza* and suggests that *Inopus* is also a synonym of the same. The position of the Australian species placed under the genus *Xenomorpha* is still uncertain, but they are allied to the genus *Chiromyza*, and the genus *Inopus* agrees better with the genus *Metoponia*, and indeed may be synonymous with it.

White, in 1916, placed *Xenomorpha* as a synonym of the genus *Metoponia*, but misstated that the wings of the latter have four posterior veins. White's mistake caused him to create the genus *Cryptoberis* for species with three posterior veins, but the genotype is a male of Macquart's female type species of the genus *Metoponia*. On this account, in the present paper, *Cryptoberis* is placed as a synonym of the genus *Metoponia*, and the genus *Xenomorpha* is used for convenience for all species of *Beridinæ* without scutellar spines and with four posterior veins present. The material to hand is not sufficient to form a better arrangement.

Key to the Genera of the Beridinæ.

1. The scutellum without spines. 2.
 The scutellum with spines. 3.
2. The wings with three posterior veins. *Metoponia.*
 The wings with four posterior veins. *Xenomorpha.*
3. The eyes bare. 4.
 The eyes hairy. *Actina.*
4. The antennæ elongate, three times as long as the head; the wings without markings. *Xanthoberis.*
 The antennæ moderately long; the wings marked with fuscous. *Neoexaireta.*

Genus Metoponia, Macquart.

Metoponia. Macquart, Dipt. Exot., suppl. 2, 1847, p. 28. *Id.*, Walker, List Dipt. B.M., v. suppl. 1, 1854, p. 112. *Id.*, Osten-Sacken, Berl. Ent. Zeit., xxvii., 1883, p. 297. *Id.*, White, Proc. Roy. Soc. Tasm., 1914. p. 46; and 1916, p. 260.

Cryptoberis, White, P.L.S. N.S.W., xli., 1916, p. 73.

Type.—*Metoponia rubriceps*, Macquart. ... ... New Holland.

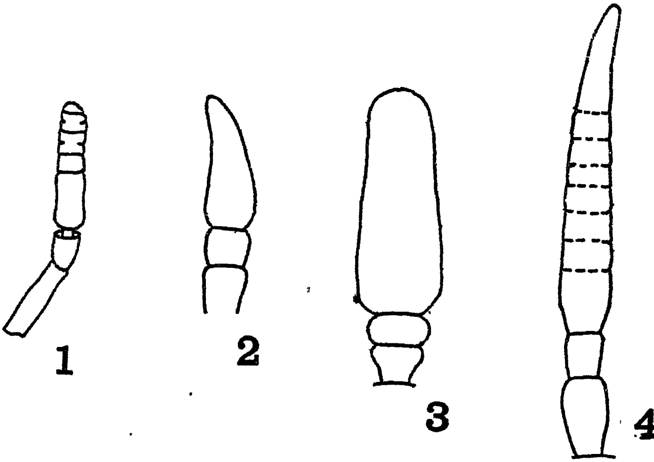
Characters.—The species in this genus have a very receding face; the eyes contiguous in the male and widely separated in the female; the abdomen with seven visible

segments and rather elongated in the female; the scutellum without spines and the whole insect devoid of strong hairs or bristles. The wings have three posterior veins, a reduced discal cell and the anal cell closed before the wing margin.

Key to the Species of Metoponia.

1. The two basal joints of the antennæ equal; a yellow brown species. *prisca.*

   The first joint of the antennæ conspicuously longer than the second; a black, brown or reddish species and the female with a reddish head. *rubriceps.*



Metoponia rubriceps, Macquart.
Text fig. 1.

Metoponia rubriceps, Macquart, Dipt. Exot., suppl. 2, 1847, p. 28, pl. i. fig. 4; and suppl. 3, 1848, p. 15. *Id.*, Walker, List Dipt. B.M., v. suppl. 1, 1854, p. 113. *Id.*, Osten-Sacken, Berl. Ent. Zeit., xxvii., 1883, p. 297. *Id.*, White, Proc. Roy. Soc. Tasm., 1914, p. 46. *Id.*, White, P.L.S. N.S.W., xli., 1916, p. 75.

Chiromyza flavicaput, Walker, Ins. Saund. Dipt., i., 1852, p. 163.

Cryptoberis herbescens, White, P.L.S. N.S.W., xli., 1916, p. 74, Text fig. 1.

Synonymy.—Dr. E. W. Ferguson has a specimen named by White as *Cryptoberis herbescens*. It was taken about the same time of the year and in the same locality as the type, and it agrees in every respect with the male of *M.*

rubriceps, Macquart, described below, and does not agree with the antennal proportions given by White. A critical study of White's description compared with a number of undescribed *Beridinæ* has led the writer to conclude that the description given by White is misleading, and therefore the above specimen determined by White is considered to be correctly identified.

Inopus despectus, Walker (Ins. Saund. Dipt.), from unknown locality may also be intended for the male of *M. rubriceps*, Macquart, but the illustration with it does not quite conform to this insect.

Description.—Male. The head is black or blackish brown; the eyes are contiguous; the second joint of the antennæ is about one quarter the length of the first, and the third joint is as long as the first and is segmented. The thorax, scutellum, and abdomen are blackish brown, and a golden yellow pubescence, very conspicuous in fresh specimens, covers a large area of the thorax dorsally, and extends on to the scutellum and abdomen; ventrally the abdomen has yellow and much shorter pubescence; the male genitalia is exposed. The legs are yellowish brown and the wings are similarly coloured.

Length.—Males, 5-6 mm.; females, 6-10 mm.

Hab.—New South Wales: Sydney, March and April, 1919, 30 males and 13 females, and November, 1919, 24 males and three females. Victoria: Melbourne, November and December, 1 male and 2 females taken by Mr. C. E. Cole. Tasmania: This locality is recorded by Macquart, but specimens are not represented from there in recent collections.

Note.—Specimens have been taken in copula during the spring and the autumn, and this places its sex relationship beyond dispute.

Metoponia prisca, Walker.

Chiromyza prisca, Walker, Ins. Saund. Dipt. i., 1852, p. 162.

Status.—A blackish species with yellow pubescence is referred here with considerable doubt. Walker's description agrees with the species described below about as well as *Chiromyza flavicaput* of the same author agrees with the previous species. Until the type is examined it is advisable to append Walker's name to this, the only species from Tasmania, the type locality, that conforms to the description in any way.

Description.—Male. The eyes have scanty pubescence and are contiguous; the front consists of ocellar and

antennal triangles, the former is black and the latter is covered with yellowish tomentum and pubescence; the antennæ are short, consisting of two equal basal joints, and the third is as long as the two basal joints united; the face recedes and has yellow tomentum and lateral pubescence. The thorax and the base of the scutellum are black with the shoulder spots and apical margin of the scutellum yellowish, the latter markings extend on to the thorax; no other markings are perceptible; the pubescence is yellow and depressed. The abdomen is black-brown with yellow pubescence. The legs are yellowish, stained with black on the tibiæ and tarsi. The wings are light grey, a little darker along the anterior half.

Female. The head is black and the eyes are widely separated; the antennæ are similar to those of the male, but the third joint is a little longer than the basal joints united. The thorax is black, similar to the male, but with the markings more extended and showing tendencies to approach those of *Xenomorpha australis*, Macquart, described below. The scutellum is yellow. The abdomen is black with the apex of most of the segments bordered conspicuously brown. The legs have the base of the segments yellowish, otherwise they are much stained with fuscous.

Length.—Male 5-6 mm.; female 10 mm.

Hab.—Tasmania: Cradle Mountain, 13 males and 10 females, January, 1917; Wynyard, 1 male, 2nd February, 1916; Mt. Wellington, 1 male, 9th January, 1919.

Note.—The resemblance of this species to *Xenomorpha australis*, Macquart, is remarkable; few points other than that of venation can be found to separate them.

Genus XENOMORPHA, Macquart.

Xenomorpha, Macquart, Dipt. Exot. i. 1, 1838, p. 193; and i. 2, 1839, p. 190.

Metoponia, White (nec Macquart), P.L.S. N.S.W., xli., 1916, p. 74.

Type.—*Xenomorpha leptiformis*, Macquart; Brazil.

Synonymy.—White mistook the characters of the genus *Metoponia*, stating that it has four posterior veins, and thus he treated *Xenomorpha* as a synonym of it.

Characters.—Until the study of the species of the world is undertaken it seems advisable to keep *Xenomorpha* as a generic name for the Australian species of *Beridinæ* with four posterior veins and without scutellar spines.

Key to the Species of Xenomorpha.

1. A non-metallic species with the antennæ short, the third joint short. *australis.*
   A species with a metallic thorax and the antennæ with the two basal joints minute, the third joint long, in proportion, and swollen. *grandicornis, sp. nov.*

Xenomorpha australis, Macquart.

Text fig. 2.

Xenomorpha australis, Macquart, Dipt. Exot., suppl. 4, 1850, p. 54, pl. iii., fig. 7. *Id.*, Williston, Trans. Ent. Soc. Phil., xv., 1888, p. 244.

Metoponia australis, White, P.L.S. N.S.W., xli., 1916, p. 75.

? *Chiromyza vicina*, Bigot, Ann. Soc. Ent. France (5), ix., 1879, p. 200.

? *Metoponia vicina*, Kertesz, Cat. Dipt. iii., 1908, p. 145.

Synonymy.—Macquart's *X. australis*, described from the East Coast of Australia, and Bigot's *C. vicina*, queried from Australia, may belong to the same species. Until the types are examined it will be impossible to determine if this is the case, and indeed Bigot's species may belong to quite a different genus.

The species described below is probably correctly identified and is the only form obtained in numbers and in sufficiently good condition to warrant a description. There seem to be a number of specimens belonging to this genus, but most of them are represented by specimens which are inferior in condition, and may ultimately prove not to be distinct.

Description.—Male. Although black, a covering of yellowish depressed pubescence gives this insect the appearance of being greyish. The eyes have scanty yellowish pubescence; the front is linear and widens above the antennæ and at the ocelli into triangular areas; the pubescence on the ocellar triangle is black and on the antennal triangle yellow; the antennæ are yellow, stained more or less with black on the two basal joints, and the third joint is as long as the two basal joints together; the proboscis is yellow; the face is very receding and has sparse whitish pubescence at the sides, and is covered with light grey tomentum which extends on to the frontal triangle. The thorax above has two faint reddish brown stripes which widen anteriorly, merge into two large shoulder spots and converge towards the scutellum, near which they disappear, the pubescence of the dorsum is yellowish and that of the

venter whitish. The scutellum is black and has yellow pubescence. Other but indistinct markings are present on the thorax and scutellum, and they appear to be remains of lateral thoracic stripes which extend on to the scutellum. The abdomen has the first segment inconspicuously margined apically with reddish brown, and the genitalia is black but more or less tipped with reddish brown; the pubescence is more or less depressed, yellow, and with lighter and darker pubescence in places. The legs are brownish at the base and apex of the segments, and have yellowish pubescence. The wings are light grey and the halteres are yellow.

Female. Black with the pubescence mostly depressed and yellow. The eyes are widely separated and have scattered pubescence; the front has yellowish tomentum and mostly brownish pubescence; it has also a deep median furrow on each side of which, half-way between the ocelli and antennæ, there is a prominence with yellow pubescence. The antennæ are reddish and are only very slightly stained black on the basal segments which have black hair; the length of the third joint is equal to that of the two basal joints united. The proboscis is reddish and the receding face has yellow tomentum and hairs. The thorax has light shoulder spots from which run a pair of median stripes and a pair of lateral stripes; the median stripes become more or less fused towards the scutellum, but the darker interval separating them is still traceable; the lateral stripes meet the median and run on to the scutellum, which is otherwise brown with a black apical tip. The abdomen is similarly coloured to that of the male and most of the segments have an inconspicuous apical brown margin, and the apical segments are much attenuated. The legs have the basal half of the segments yellowish. The wings and halteres are as in the male.

Length —Male, 10 mm.; female, 13-15 mm.

Hab.—Victoria: Gisborne, 5 males and 4 females, collected by G. Lyell.

Xenomorpha grandicornis, *sp. nov.*

Text fig. 3.

Description.—In general appearance this species is similar to *Actina incisuralis*, Macquart. The antennæ will distinguish it from any other *Beridinæ* known.

Male. The head is black and the eyes are widely separated and pubescent; the front is shining and has black pubescence and about half-way between the antennæ and the ocelli there is a transverse impression from which

run two parallel grooves to the ocelli and one median groove to the base of the antennæ. The antennæ have the first two joints short, small and equal, and the third joint is about four times as long as the two basal joints united, much swollen, cylindrical but slightly tapering apically, without segments, velvety black and bare of hairs. The face does not recede as in *X. australis*, and has black hairs. The thorax and scutellum are metallic blue and have black pubescence; on the shoulders and behind the wings there are yellowish markings. The abdomen is black with black pubescence, and the genitalia is reddish. The legs have the apex of the femora, and the base and apex of the tibiæ yellowish red; the first tarsal joints are more or less red. The wings are greyish.

Length.—Male 7 mm.

Hab.—Tasmania: Cradle Mountain (Pencil Pine Creek?), one male taken on the 17th January, 1917.

Genus ACTINA, Meigen.

Actina, Meigen, Klassif i., 1804, p. 116. *Id.*, White, Proc. Roy. Soc. Tasm., 1914, p. 49. *Id.*, White, P.L.S. N.S.W., xli, 1916, p. 77.

Type.—*Actina nitens*, Latrielle. ... ... Europe.

Characters.—The eyes are hairy and widely separated in both sexes; the scutellum has four spines; the abdomen consists of seven visible segments; the wings contain four posterior veins all issuing from the discal cell, and the anal cell is closed before the wing margin.

Key to the Species of Actina.

1. The two basal joints of the antennæ about equal. *victoriæ.*
   The first antennal joint about twice the length of the second. 2.
2. The scutellar spines always partly yellow at least; a species very variable in size. *incisuralis.*
   The scutellar spines always entirely metallic green; a very small species. *costata.*

The character used for *A. victoriæ*, Hill, in the above key is taken from the description of that species.

Actina incisuralis, Macquart.

Beris incisuralis, Macquart, Dipt. Exot., suppl. 2, 1847, p. 28; and suppl. 4, 1850, p. 42. *Id.*, Walker, List Dipt. B.M., v. suppl. 1, 1854, p. 12.

Beris filipalpis, Macquart, Dipt. Exot., suppl. 4, 1850, p. 41, Pl. iii., fig. 2, 1850.

Actina incisuralis, White, Proc. Roy. Soc. Tasm., 1914, p. 50. *Id.*, White, P.L.S. N.S.W., xli., 1916, p. 77.

?Beris fuscirentris, Macquart, Dipt. Exot., suppl. 4, 1850, p. 42. *Id.*, White, Proc. Roy. Soc. Tasm., 1914, p. 49. *Id.*, White, P.L.S. N.S.W., xli., 1916, p. 97.

?Beris nitidithorax, Macquart, Dipt. Exot., suppl. 4, 1850, p. 41, Pl. iii., fig 3. *Id.*, White, Proc. Roy. Soc. Tasm., 1914, p. 49. *Id.*, White, P.L.S. N.S.W., xli., 1916, p. 97.

Synonymy.—It is possible that *Beris fuscirentris* and *B. nitidithorax*, both described by Macquart, may belong here; it will be noted that the reference to a figure given by Macquart under the former does not belong to that species but to *Stratiomyia nasuta*.

Hab.—Specimens have been examined from Queensland, New South Wales, South Australia, Western Australia, and Tasmania. The species has also been recorded from Victoria.

Actina costata, White.

Actina costata, White, Proc. Roy. Soc. Tasm., 1914, p. 51. *Id.*, White, P.L.S. N.S.W., xli., 1916, p. 77.

Hab.—This species is only known from Tasmania, and it can be taken in quantities on Mt. Wellington, about 2,000ft.

Actina victoriæ, Hill.

Actina victoriæ, Hill, P.L.S. N.S.W., xliv. (2), 1919, p. 450, figs. 1 a-c.

Status.—From the description this species appears more or less similar to *A. incisuralis*, White, but the basal joints of the antennæ are described as about equal in length.

Genus XANTHOBERIS, White.

Xanthoberis, White, P.L.S. N.S.W., xli., 1916, p. 75.

Type.—*Xanthoberis siliacea*, White.
... ... New South Wales.

Xanthoberis siliacea, White.

Xanthoberis siliacea, White, P.L.S. N.S.W., xli., 1916, p. 76, text fig. 2.

Genus Neoexaireta, Osten-Sacken.

Diphysa, Macquart, Dipt. Exot. i. 1, 1838, p. 172 (preoccupied). *Id.*, Walker, List Dipt. B.M., v. suppl. 1, p. 6.

Exaireta, Schiner, Verh. z.-b. Ges. Wien, xvii., 1867, p. 309 (preoccupied).

Neoexaireta, Osten-Sacken, Cat. Dipt. N. America, Edit. 2, 1878, p. 44. *Id.*, Enderlein, Zool. Anzeiger, xlii., 1913, p. 552, figs. 17-19. *Id.*, White, Proc. Roy. Soc. Tasm. 1914, p. 48. *Id.*, White, P.L.S. N.S.W., xli., 1916, p. 78.

Neoexaereta, Kertesz, Cat. Dipt., iii., 1908, p. 131.

Type.—*Xylophagus spiniger*, Wiedemann, ... Port Jackson.

Emendments.—Enderlein described this genus, after Macquart's figures, as having the radial vein (his r2-3) branching from the cubital (his r main stem) beyond the median cross vein, but Australian specimens have the radial vein branching interstatial with the median cross vein. Macquart's figures, and hence Enderlein's, show the scutellar spines to be conspicuously curved instead of straight or slightly curved and the antennæ differ considerably.

Characters.—The eyes are bare and separated in both sexes; the antennæ are moderately long, the third joint consisting of eight segments; the scutellum contains four spines; the abdomen consists of seven visible segments; the wings contain four posterior veins, the third of which does not reach the wing margin, and they all branch from the discoidal cell; also the wings are much marked with fuscous.

Neoexaireta spinigera, Wiedemann.

Text fig. 4.

Xylophagus spiniger, Wiedemann, Auss. Zweifl. ii., 1830, p. 618.

Diphysa spiniger. Macquart, Dipt. Exot. i. 1, 1830, p. 172. *Id.*, Walker, List. Dipt. B.M., iv., 1849, p. 1152.

Beris spinigera, Loew, Stett. Ent. Zeit., vii., 1846, p. 306.

Sargus spinigera. Kirby, Ann. Mag. Nat. Hist. (5) xiii., 1884, p. 457.

Neoexaireta spinigera, Froggatt, Australian Insects, 1907, p. 293. *Id.*, White, Proc. Roy. Soc. Tasm., 1914, p. 48. *Id.*, White, P.L.S. N.S.W., xli., 1916, p. 78. *Id.*, Hardy, Proc. Roy. Soc. Tasm., 1917, p. 63.

Beris albimaculata, Walker, List Dipt. B.M. i., 1848, p. 126.

Beris servillei, Macquart, Dipt. Exot. i. 1, 1838, p. 172, Pl. xxi., fig. 1; and suppl. 1, 1846, p. 47.

(For further references see Kertesz, Cat. Dipt. iii., 1908, p. 132.)

Hab.—A very common species which has been recorded from Queensland, New South Wales, Victoria, and Tasmania, and also from some of the Pacific Islands.

Subfam. PACHYGASTERINÆ.

Characters.—The Australian species of this subfamily have short antennæ, the third joint of which is swollen, formed with a number of compact segments, and has a hair-like arista; the abdomen is formed with five visible segments, and the wings contain three posterior veins.

The four genera so far known to occur in Australia differ in the form of the scutellum which is normal and without spines in *Pachygaster*, is produced into a spine in *Lonchegaster*, has four spines in *Evaza*, and has many spines in *Wallacea*.

Genus PACHYGÁSTER, Meigen.

Pachygaster, Meigen, Ill. Mag. f. Ins., ii., 1803, p. 266. *Id.*, White, P.L.S. N.S.W., xli., 1916, p. 96.

(For synonymy see Kertesz, Cat. Dipt. iii., 1908, p. 9.)

Type.—*Nemotelus ater*, Panz. ... ... Europe.

Characters.—The antennæ are three jointed, and the third joint is bulbous and consists of several much compressed segments terminating in a long arista; the scutellum is without spines; the wings contain three posterior veins which issue from the discal cell.

Note.—White has a Tasmanian specimen of this genus in his collection, but he considered it to be a Lonchegaster with the spines broken or deformed; this specimen should now be in the British Museum, and probably belongs to the species described below. Later White recorded the genus from Victoria, but did not describe the species. Another species is represented by a specimen in the Macleay Museum from Mt. Kembla, New South Wales, but until further material is to hand it is not advisable to describe this or the many other new diptera in this old collection, most of which dates back fifty years and more.

The species described here is named after the late Arthur White.

Pachygaster whitei, sp. nov.

Pachygaster sp., Hardy, Proc. Roy. Soc. Tasm., 1917, p. 63.

? *Pachygaster sp.*, White, P.L.S. N.S.W., xli., 1916, p. 97.

Description.—Female. Black; the antennæ are reddish; the femora and tibiæ are reddish, but are stained darker in parts; the tarsi are yellow.

The front is shining and a little punctate; two more or less parallel depressions contain the unevenly distributed punctures, and run from the ocellar tubercle towards the antennæ, ending at a deeper median depression situated a little before the antennæ. The eyes are bare. The thorax, scutellum, and abdomen are evenly and densely punctate dorsally, and the punctures are unevenly dense ventrally; all the punctures are small. The pubescence is silvery around the antennæ and mouth, elsewhere it is golden yellow; some very inconspicuous black pubescence can be seen on the front and elsewhere. The wings are hyaline and the veins are reddish and dusky yellowish. The halteres are yellow with black apices.

The male is similar to the female, but is more slender in build; the eyes are approximate, and the punctures on the body appear a little less uniformly and densely distributed; the legs are pale yellow, and the femora are stained with fuscous; the halteres are pale yellow.

Variation.—A female from Dunalley has the legs similar to those of the male.

Length.—Male, 4 mm.; female, 3½-4½ mm.

Type.—The holotype ♀ was taken at Hobart on the 26th January, 1917, the allotype ♂ came from the same locality on the 29th December, 1917; both these specimens are in the Australian Museum. Two female paratypes are from Hobart on the 22nd January, 1916, and Dunalley 29th January, 1918, respectively. In all there are one male and three females taken in and around dwellings, three in the centre of Hobart and one in a farmhouse at Dunalley.

Hab.—Tasmania. The specimen recorded by White may belong to this species. The flight is similar to that of species belonging to the genus *Odontomyia*.

Genus LONCHEGASTER, White.

Lonchegaster, White, Proc. Roy. Soc. Tasm., 1914, p. 61.
Id., White, P.L.S. N.S.W., xli., 1916, p. 97.

Type.—*Lonchegaster armata*, White. ... ... Tasmania.

Characters.—The eyes are contiguous in the male and separate in the female; the scutellum is produced into a spine; and the wings contain three posterior veins. The genus differs from the *Platynini* to which group it otherwise belongs according to Enderlein's keys (Zool. Anz., 1914), by the contiguous eyes of the male.

Lonchegaster armata, White.

Lonchegaster armata, White, Proc. Roy. Soc. Tasm., 1914, p. 62. fig. 7. *Id.*, White, P.L.S. N.S.W., xli., 1916, p 97.

Note.—It appears that this insect has a superficial resemblance to *Pachygaster whitei*, from which it can be distinguished by the scutellum and the blue-black abdomen.

Hab.—Tasmania. A paratype is in the National Museum, Melbourne..

Genus EVAZA, Walker.

Evaza, Walker. Proc. Lin. Soc. Lond., i., 1857, p. 109. *Id* , Kertesz, Ann. Mus. Nat. Hung., iv., 1906, p. 277.

Type.—*Evaza bipars*, Walker. ... ... Borneo.

Evaza bipars, Walker.

Evaza bipars, Walker, Proc. Lin. Soc. Lond., i., 1857, p. 110, Pl. 6, fig. 2. *Id.*, Kertesz, Ann. Mus. Nat. Hung., iv., 1906, p. 284, Pl. 5, fig. 1.

Hab.—This species was described from Borneo, and reported since from New Guinea and New South Wales.

Genus WALLACEA, Doleschal.

Wallacea, Doleschal, Nat. Tijdschr. Nederl. Ind. (4), iii. (xvii.), 1858, p. 82.

Type.—*Wallacea argentea*, Doleschal ... Ambonia.

Wallacea darwini, Hill,

Wallacea darwini, Hill, P.L.S. N.S.W., xliv., 1919, p. 460, figs. 7 a-c.

Subfam. LOPHOTELLINÆ.

Characters.—This subfamily contains species with three posterior veins issuing from the discal cell; the scutellum without spines; and the last segment of the antennæ ribbon-like.

Note.—A single Australian representative was described by Enderiein from a specimen with broken wings, and the assumption that there are only three posterior

veins present (i.e., the median is two branched in the terms used by Enderlein) requires confirmation.

The Australian Museum and the Macleay Museum have, between them, about thirty unidentified specimens, many of which are referable to this and the next subfamily, but unfortunately the specimens in the Australian Museum are not in a suitable condition to be studied with advantage, and those in the Macleay Museum do not seem to belong to the described forms. There is, however, sufficient material with diversity of characters to warrant a special warning against the assumption of venational characters made by Enderlein.

Genus PERATOMASTIX, Enderlein.

Peratomastix, Enderlein, Zool. Anzeiger, xliii., 1914, p. 311, fig. 16.

Type.— *Peratomastix australis*, Enderlein. ... ... New South Wales.

Peratomastix australis, Enderlein.

Peratomastix australis, Enderlein, Zool. Anzeiger, xliii., 1914, p. 311.

Subfam. HERMETIINÆ.

Characters.—This subfamily differs from the previous chiefly in the presence of a fourth posterior vein.

Note.—The material to hand is not in sufficient abundance or in sufficiently good condition to enable the species represented to be studied with advantage. Brauer's genus *Lagenosoma* is considered to be identical with Walker's genus *Massicyta*, and although this appears to be correct further information on the subject is desirable.

Genus Massicyta, Walker.

Massicyta, Walker, Proc. Lin Soc. Lond., i., 1857, p. 8, Pl. i., fig. 1. *Id.*, Enderlein, Zool. Anz., xliv, 1914, p. 8.

Lagenosoma, Brauer, Denkschr. Akad. Wien., xliv., 1882, p. 81.

Type of *Massicyta*.—*M. bicolor*, Walker ... Singapore.

Type of *Lagenosoma*.—*L. picta*, Brauer ... Cape York.

Massicyta picta, Brauer.

Lagenosoma picta, Brauer, Denkschr. Akad. Wien, xliv, 1882, p. 81.

Massicyta dispar, Brauer.

Lagenosoma dispar, Brauer, Denschr. Akad. Wien., xliv., 1882, p. 82.

Massicyta propinqua, Brauer.

Lagenosoma propinqua, Brauer, Denschr. Akad. Wien., xliv., 1882, p. 82.

Genus HERMETIA, Latrielle.

Hermetia, Latrielle, Hist. Nat. d. Crust. et Ins., xiv., 1804, p. 338.

Type.—*Hermetia illucens*, Latrielle. ... ... America.

Hermetia pallidipes, Hill.

Hermetia pallidipes, Hill, P.L.S. N.S.W., xliv., 1919, p. 454, text figs. 3 a-b.

Emendments:—A letter received from Mr. Hill contains the following note.—"Re *Hermetia pallidipes*; I have re-examined the type with the following results.—The third joint of the antennæ has six annulations visible; what I have shown as an outstanding tuft of hairs may arise from a very short and very obscure annulation (the seventh), but this could only be ascertained by examination of a balsam preparation. The groove below the same joint covers segments 4, 5, and 6 in both sexes. The wing of the male is correctly drawn; in the female there is a space equal to about twice the width of the intermediate vein between it and its junction with the radial vein."

From this it becomes apparent that Mr. Hill's species is placed in its correct genus, and, therefore, must not be confused with several closely allied species in various collections which differ in the antennal groove and other particulars.

Four specimens in the Macleay Museum, from Cape York, also belong to the genus *Hermetia*, and may be identical with this species.

Subfam. SARGARINÆ.

Note.—Enderlein renamed this subfamily *Geosargarinæ*, but the generic name was changed on an alleged preoccupation which was not sustained, and consequently the origial subfamily name must be restored.

Key to the Genera of the Sargarinæ.

1. Scutellum without spines, bright metallic species. *Sargus*.

Scutellum with spines, black species. *Acanthasargus*.

Genus SARGUS, Fabricius.

Sargus, Fabricius, Suppl. Entomol. Syst., 1798, p. 549. *Id.*, White, P.L.S. N.S.W., xli., 1916, p. 94.

Type.—*Sargus cuprarius*, Fabricius ... ... Europe.

Sargus meridionalis, White.

Sargus meridionalis, White, P.L.S. N.S.W., xli.. 1916, p. 95.

Sargus gselli, Hill.

Sargus gselli, Hill, P.L.S. N.S.W., xliv., 1919, p. 459, fig. 6 a-c.

Genus ACANTHASARGUS, White.

Acanthasargus, White, Proc. Roy. Soc. Tasm., 1914, p. 60. *Id.*, White, P.L.S. N.S.W., xli., p. 95.

Type.—*Acanthasargus pallustris*, White ... Tasmania.

Acanthasargus pallustris, White.

Acanthasargus pallustris, White, Proc. Roy Soc. Tasm., 1914, p. 60, fig. 6. *Id.*, White, P.L.S. N.S.W., xli., 1916, p. 96.

Acanthasargus gracilis, White.

Acanthasargus gracilis, White, P.L.S. N.S.W., xli., 1916, p. 98.

Subfam. CLITELLARINÆ.

Note.—Enderlein included the *Antissini* under this subfamily and created a new tribe *Abavini*.

Key to the Tribes of the Clitellarinæ.

1. The scutellum without spines. *Abavini.*
 The scutellum with spines. 2.
2. The scutellum with two spines. *Clitellariini.*
 The scutellum with four or more spines. *Antissini.*

Tribe CLITELLARIINI.

Key to the Genera of the Clitellariini.

1. The thorax with a stout spine on each side; the antennæ with a long dense fringed style. *Negritomyia.*
 The thorax without such spines; the antennæ without a fringed style. 2.
2. The antennæ with an arista; the posterior legs with the first joint of the tarsi longer than the tibiæ. *Geranopus.*
 The antennæ without an arista. 3.

3. The antennæ very long and slender, about five times the length of the head. *Elissoma.*
The antennæ not slender, about twice the length of the head. *Ophiodesma.*

Genus NEGRITOMYIA, Bigot.

Nigritomyia, Bigot, Ann. Soc. Ent. France (5) vii., Bull, 1877, p. lxxiv.

Negritomyia, Bigot, Ann. Soc. Ent. France (5) ix., 1879, p. 190. *Id.*, White, P.L.S. N.S.W., xli., 1916, p. 82.

(For further references see Kertesz, Cat. Dipt. iii., 1908, p. 16.)

Type.—*Ephippium maculipennis*, Macquart. . Manilla.

Negritomyia albitarsis, Bigot.

Ephippium albitarsis, Bigot, Ann. Soc. Ent. France (5) ix., 1879, p. 207. *Id.*, Froggatt, P.L.S. N.S.W., xxi., 1896, p. 84, Pl. ix., figs. 12-13. *Id.*, Froggatt, Australian Insects, 1907, p. 293.

Negritomyia albitarsis, White, P.L.S. N.S.W., xli., 1916, p. 83. Text fig. 4. *Id.*, Hill, P.L.S. N.S.W., xliv., 1919, p. 452. Text fig. 2.

Hab.—This is a common species from the northern parts of Australia and from New Guinea. There are seven specimens in the Macleay Museum from Queensland.

Genus GERANOPUS, White.

Geranopus, White, P.L.S. N.S.W., xli., 1916, p. 84.

Type.—*G. purpuratus*, White. ... ... Victoria.

Geranopus purpuratus, White.

Geranopus purpuratus, White, P.L.S. N.S.W., xli., 1916, p. 85. Text figs. 5 and 6.

Genus ELLISSOMA, White.

Elissoma, White, P.L.S. N.S.W., xli., 1916, p. 86.

Type.—*Elissoma lauta*, White. ... ... Victoria.

Elissoma lauta, White.

Elissoma lauta, White, P.L.S. N.S.W., xli., 1916, p. 87.

Genus OPHIODESMA, White.

Ophiodesma, White, P.L.S. N.S.W., xli., 1916, p. 88.

Type.—*Odontomyia flavipalpis*, Macquart. ... ... New Holland.

Ophiodesma flavipalpis, Macquart.

Pl. VIII., fig. 1.

Odontomyia flavipalpis, Macquart, Dipt. Exot., suppl. 4, 1850, p. 49.

Ophiodesma flavipalpis, White, P.L.S. N.S.W., xli., 1916, p. 89. Text fig. 7.

Hab.—Eleven specimens in the Macleay Museum are labelled from Queensland, New South Wales, and Western Australia; the species has already been recorded from Victoria, and therefore it is probable that it will be found throughout the whole of the mainland of Australia. Two specimens, one of each sex, were taken at Blackheath, New South Wales, during November, 1919.

Tribe ABAVINI.

Genus ANACANTHELLA, Macquart.

Anacanthella, Macquart, Dipt. Exot., Suppl. 5, 1855, p. 38. *Id.*, Enderlein, Zool. Anzeiger, xliv., 1914, p. 23. *Id.*, White, P.L.S. N.S.W., xli., 1916, p. 80.

Type.—*Anacanthella splendens*, Macquart.... Adelaide.

Status.—This genus is placed in this position by Enderlein, who makes interesting though speculative remarks concerning it. No recent specimens of the species are known.

Anacanthella splendens, Macquart.

Anacanthella splendens, Macquart, Dipt. Exot., suppl. 5, 1855, p. 39, Pl. i., fig. 8. *Id.*, White, P.L.S. N.S.W., xli., 1916, p. 80.

Tribe ANTISSINI.

Key to the Genera of the Antissini.

1. The scutellum with four or six normal spines; the male with the costa of the wings greatly inflated; the antennæ as long as the head. *Lecomyia.*
   The scutellum with six rudimentary spines; the costa of the wings normal. 2.
2. The antennæ much shorter than the head. *Antissa.*
   The antennæ twice as long as the head. *Antissella.*

Genus LECOMYIA, White.

Lecogaster, White, Proc. Roy. Soc. Tasm., 1914, p. 53 (preoccupied). *Id.*, White, P.L.S. N.S.W., xli, 1916, p. 79.

Lecomyia, White, Proc. Roy. Soc. Tasm., 1916, p. 260.

Type.—*Lecogaster cærulea*, White ... ... Tasmania.

Note.—This genus is apparently well represented in Australia; there are four undescribed species as well as the two described represented in the Macleay Musum.

Key to the Species of the Genus Lecomyia.

1. The thorax blue; the scutellum normal, lying in the same plane as the thorax; the wings hyaline. *quinquecella.*

   The thorax black, the scutellum upraised, not lying in the same plane as the thorax; the wings with a black spot at the middle of the costal margin. *cyanea.*

Lecomyia quinquecella, Macquart.

Beris quinquecella, Macquart, Dipt. Exot., suppl. 1, 1846, p. 47, Pl. v., fig. 2. *Id.*, Walker, List Dipt. B.M., v. suppl. 1, 1854, p. 12. *Id.*, White, Proc. Roy. Soc. Tasm., 1914, p. 49. *Id.*, White, P.L.S. N.S.W., xli., 1916, p. 97.

Lecogaster cærulea, White, Proc. Roy. Soc. Tasm., 1914, p. 54. Text fig. 5. *Id.*, P.L.S. N.S.W., xli., 1916, p. 79.

Synonymy.—White placed *Beris quinquecella*, Macquart, amongst his doubtful species, but Macquart's illustration was undoubtedly intended to represent this species, as the inflation of the costa, although shown small in the drawing, leaves no doubt concerning the generic position, and the locality given is Tasmania.

Emendments:—In Macquart's description and illustrations, the scutellum is described with four spines, and correctly illustrated with eight, and the five posterior cells described are erroneously drawn as four. Allowing for these corrections, Macquart's description and drawing conform to this species.

Lecomyia cyanea, White.

Lecogaster cyanea, White, P.L.S. N.S.W., xli., 1916, p. 79. Text fig. 3.

Genus Antissa, Walker.

Antissa, Walker, List Dipt. B.M., v. suppl. 1, 1854, p. 63. *Id.*, Brauer, Denkschr. Akad. Weiss. Wien., xliv., 1882, p. 71. *Id.*, Brauer, Offines schr., 1883, p. 7. *Id.*, Osten-Sacken, Berl. Ent. Zeit., xxvi., 1882, p. 373. *Id.*, Enderlein, Zool. Anzeiger, xliv., 1914, p. 11. *Id.*, White, P.L.S. N.S.W., 1916, p. 81.

Type.—*Antissa cuprea*, Walker ... Western Australia.

Antissa cuprea, Walker.

Clitellaria cuprea, Walker, List Dipt. B.M., iii., 1849, p. 524.

Antissa cuprea, Walker, List Dipt. B.M., v. suppl. 1, 1854, p. 63. *Id.*, Braur, Offines schr., 1883, p. 7. *Id.*, White, P.L.S. N.S.W., xli, 1916, p. 81.

Genus ANTISSELLA, Walker.

Antissella, White, Proc. Roy. Soc. Tasm., 1914, p 52. Text fig. 4. *Id.*, White, P.L.S. N.S.W., xli., 1916, p. 81.

Type.—*Beris parvidentata*, Macquart ... Tasmania.

Status.—White placed the genus *Antissella* near *Antissa*, but neither this nor *Anacanthella* has been recognised since they were described, and also the descriptions afford insufficient data to settle relationships. The three genera need further study.

Antissella parvidentata, Macquart.

Beris parvidentata, Macquart, Dipt. Exot., suppl. 4, 1894, p. 40, Pl. iii., fig. 1.

Antissella parvidentata, White, Proc., Roy. Soc. Tasm., 1914, p. 52. Text fig. 4. *Id.*, White, P.L.S. N.S.W., xli., 1916, p. 81.

Subfam. STRATIOMYIINÆ.

Notes.—The Australian species of this subfamily are placed in one genus, and from their descriptions are liable to be considerably confused. Before new material can be dealt with much further research is needed, especially with reference to the types. The present study is based upon numerous examples with the intention of finding the limits of species and specific variation, and thus laying the basis for further study on structural rather than colour characters.

Where no structural characters have been found to separate species undoubtedly distinct, colour characters have been taken into account rather for a guide than for final conclusions. No structural characters have been found to separate *O. carinifacies*, Macquart, *O. sydneyensis*, Schiner, and some forms of *O. decipiens*, Guerin, and yet they are apparently distinct species that are found not to merge into each other when long series are examined. *O. decipiens*, Guerin, will be found to comprise a large number of variations, and although many of these at first sight appear distinct, they cannot be separated when series of considerable length are examined.

The writer's convictions of the specific value of the various descriptions will be found embodied in the synonymy and the remarks made thereon. Until the types are examined, and the suggestions made in this work are confirmed or corrected, the identification of the majority of the species will be unsatisfactory.

Genus ODONTOMYIA, Meigen.

Eulalia, Meigen, Nov. Class. 1800, p. 21 (name not permissible). *Id.*, Kertesz, Cat. Dipt., iii., 1908, p. 62 (which see for synonymy).

Odontomyia, Meigen, Ill. Mag. f. Ins., ii., 1803, p. 265. *Id.*, White, Proc. Roy. Soc. Tasm., 1914, p. 55. *Id.*, White, P.L.S. N.S.W., xli., 1916, p. 90. *Id.*, Hardy, Proc. Roy. Soc. Tasm., 1917, p. 61.

Type.—*Odontomyia ornata*, Meigen ... ... Europe.

Characters.—The species of this genus contain a much depressed five segmented abdomen and a scutellum with two spines (aberrant specimens in which these spines are absent or deformed are rare and do not exceed one in five hundred). The antennæ have the third joint longer than the two basal joints united, and it terminates in a short style. The wings contain four posterior veins rising from the discal cell.

Key to the Species of Odontomyia.

1. The scutellar spines below (not at the apical margin of) the scutellum and inconspicuous. The antennæ have the two basal joints united nearly as long as the third. *opertanea.*

   The scutellar spines conspicuous and situated at the apical margin of the scutellum. The antennæ with the two basal joints together much shorter than the third. 2.

2. The scutellar spines very strong and curved upwards so that they have their apices pointing almost perpendicular to the abdomen. *scutellata.*

   The scutellar spines normal, their axis lying in a plane about parallel to the abdomen. 3.

3. The scutellar spines long and straight and as wide apart as in Plate VIII., fig. 4. The abdominal sidespots are large, sometimes almost confluent, generally triangular. The face always black. *lateromaculata.*

   The scutellar spines short and closer together, never wider apart than as illustrated on Pl. VIII., fig. 6. If the abdomen has side-spots they are generally small, thin, and quadrangular elongate; if the side-spots are large they are generally confluent. 4.

4. The abdomen with side-spots. 5.
The abdomen with side margins yellow or green. *decipiens.*
5. The face black, generally narrowly margined yellow. *carinifacies.*
The face yellow. *sydneyensis.*

Note.—*O. hunteri*, Macleay, and *O stricta*, Erichson, are not included in the above key; they may be distinct species or varieties, or they may be identical with any of the other species, but no specimens are to hand that can in any way be associated with their respective descriptions. The two species described by Mr. Hill have their scutellar spines inadequately described, and therefore their position in relation to the above key cannot be ascertained at present.

Odontomyia scutellata, Macquart.

Pl. VIII., fig. 2 and 3.

Odontomyia scutellata, Macquart, Dipt. Exot., suppl. 1, 1846, p. 52, Pl. v., fig. 7. *Id.*, White, Proc. Roy. Soc. Tasm., 1914, p. 59. *Id.*, White, P.L.S. N.S.W., xli., 1916, p. 91.

Stratiomyia scutellata, Walker, List Dipt. B.M., v. suppl. 1, 1854, p. 55.

Status.—No doubt can exist about the correct identification of this species. White took it just prior to the time he left Tasmania, but one specimen, in bad preservation, was in the Tasmanian Museum collection; later several isolated specimens were taken, and more recently, when more was known about their habits, a long series was obtained.

Hab.—New South Wales, Victoria, and Tasmania.

Odontomyia laterimaculata, Macquart.

Pl. VIII., fig. 4.

Odontomyia laterimaculata, Macquart, Dipt. Exot,, suppl. 4, 1850, p. 49. ? *Id.*, White, Proc. Roy. Soc. Tasm., 1914, p. 58 (male only). ? *Id.*, White, P.L.S. N.S.W., xli., 1916, p. 94 (male only).

Status.—White's identification of this species requires confirmation. White identified it as the larger of two similar species, both of which occur in Tasmania as well as on the mainland of Australia. The two species, *O. carinifacies*, Macquart, from Tasmania, and *O. laterimaculata*, Macquart, from Australia, are not to be separated by Macquart's descriptions; both are described from the male,

and the typical male of *O. carinifacies*, Macquart, as identified by White, is not represented in any recent collection from the type locality, and this suggests that White transposed the name, if indeed Macquart's species are really distinct. The key to the solution lies in the fact that White's *O. laterimaculata*, male, has the scutellar spines wider apart and longer than in those identified by White as *O. carinifacies*. An examination of the structure of Macquart's types will easily determine if White transposed the names.

The specimen identified by White as *O. laterimaculata*, female, is not the female of his male, as the species has been taken in copula on several occasions in Tasmania. On this account White's female is referred to *O. sydneyensis*, Schiner, as the description conforms to that species, nevertheless the form has not been seen by me from that State.

Hab.—Tasmania, Victoria and New South Wales.

Type.—The male specimen upon which White identified the species is in the Australian Museum.

Odontomyia carinifacies, Macquart.

Pl. VIII., fig. 5.

Odontomyia carinifacies, Macquart, Dipt. Exot. Suppl. 4, 1850, p. 51. ? *Id.*, White, Proc. Roy. Soc. Tasm., 1914, p. 57. ? *Id.*, White, P.L.S. N.S.W., xli., 1916, p. 94.

Status.—White identified this as the smaller of two similar species, but Macquart's description is not to be separated from *O. laterimaculata*, Macquart, under which species further remarks are supplied.

The typical male of the species identified by White is not known in recent collections, but a mountain form described below as a variety is much smaller and has the male with the colour pattern similar to that of the female.

The only male that can be associated with the typical form has a distinctive colour pattern, and is described, apparently for the first time, under the second variety name below.

Odontomyia carinifacies, var. minima, var. nov.

Pl. VIII., fig. 7.

Description.—A small mountain variety of *O. carinifacies* (as identified by White) occurs on Mt. Wellington, Hobart, Tasmania, at about the altitude of 2,000ft. The males are common and the females scarce, and on two occasions specimens have been taken in copula.

The abdomen is shorter and more compact than in the typical form, and is illustrated on Pl. VIII., fig. 7, which figure was drawn from the holotype var.

Length never exceeding 8 mm., and averaging 7½ mm.

Odontomyia carinifacies, var. grandimaculata, var. nov.

Pl. VIII., fig. 6.

Status.—A male of average size, but remarkably different in colour and spots on the abdomen, taken in abundance with the typical females, is here given a special form name. It is possible that this variety represents a distinct species, but without a female of the variety or a male of the typical form it is not advisable to separate them.

Description.—The abdomen and scutellum are illustrated on Pl. VIII., fig. 6; the abdomen is black with large reddish confluent or almost confluent side-spots which are generally confluent on the extreme lateral edges. In other respects the variety is similar to the typical form, but the legs may be black or reddish, or may contain both these colours.

Length.—8-10 mm.

Hab.—Tasmania: Bream Creek, February, 1918, 36 specimens; Garden Island Creek, December, 1916, 1 specimen; Lymington, December, 1916, 3 specimens.

South Australia: Two specimens in the Macleay Museum are labelled from this State and conform to the variety.

Note.—Four stray specimens were taken at Lymington and Garden Island Creek, and later specimens were met with in large quantities at Bream Creek, where large series of the male variety and of the female typical form were taken. A second visit was made to Bream Creek for the purpose of securing a pair in copula and thus definitely ascertaining the sex relationship, but unfortunately the weather turned cloudy and the object of the trip was not attained, but a second and longer series of the two forms was taken.

Odontomyia sydneyensis, Schiner.

Odontomyia sydneyensis, Schiner, Nov. Reise, Dipt., 1868, p. 60.

? *Odontomyia laterimaculata*, ♀ White, Proc. Roy. Soc. Tasm., 1914, p. 58. ? *Id.*, White, P.L.S. N.S.W., xli., 1916, p. 94.

Synonymy.—*O. laterimaculata*, Macquart (as identified by White), has been taken in copula on several occasions

in Tasmania, and the female has invariably a black face and front, not fulvous, and is as large as the male. A smaller specimen with a yellow face and front is not represented in many collections, but conforms to the description of *O. sydneyensis*, Schiner, and White's female record of *O. laterimaculata* probably belongs here, but doubt must be placed upon its identity with *O. sydneyensis*, Schiner, as this species is not represented from Tasmania in any collection.

Status.—This species, described by Schiner, was entirely overlooked by White, and the remark under the description given by Schiner to the effect that it seems to be related to *O. laterimaculata*, Macquart, suggests that the *O. carinifacies* of White is the true *O. laterimaculata* of Macquart. Until the status of each of these various species is inquired into and established by examination of the type material the determination of the species of the *Odontomyia* in Australia will remain unsatisfactory.

Hab.—New South Wales, Sydney.

Odontomyia decipiens, Guerin.

Pl. VIII., fig. 8 and 9.

Oxycera decipiens, Guerin, Voy. Coq. zool. 2, ii., 1830, p. 291.

Hermione decipiens, Kertesz, Cat. Dipt. iii., 1908, p. 33.

Odontomyia regisgeorgii, Macquart, Dipt. Exot. i., 1, 1838, p. 186. *Id.*, White, P.L.S. N.S.W., xli., 1916, pp. 90 and 100.

Stratiomys regisgeorgii, Walker, List. Dipt. B.M., v. suppl. 1, 1854, p. 56.

Odontomyia carinata, Macquart, Dipt. Exot., suppl. 1, 1846, p. 52. *Id.*, White, Proc. Roy. Soc. Tasm., 1914, p. 59; and 1916, p. 260. *Id.*, White, P.L.S. N.S.W., xli., 1916, p. 90.

Stratiomys carinata, Walker, List. Dipt. B.M., v. suppl. 1, 1854, pp. 56 and 312.

Odontomyia stylata, Macquart, Dipt. Exot., suppl. 2, 1847, p. 30; and suppl. 4, 1850, p. 52. *Id.*, Froggatt, Australian Insects, 1907, p. 294. *Id.*, White, Proc. Roy. Soc. Tasm., 1914, p. 56. *Id.*, White, P.L.S. N.S.W., xli., 1916, p. 90.

Stratiomys stylata, Walker, List. Dipt. B.M., v. suppl. 1, 1854, p. 56.

Odontomyia ialemus, Walker, List Dipt. B.M., iii., 1849, p. 535. *Id.*, Bigot, Ann. Soc. Ent. France (5), ix., 1879, p. 186. *Id.*, White, P.L.S. N.S.W., xli., 1916, p. 90.

Stratiomys ialemus, Walker, List. Dipt. B.M., v. suppl. 1, 1854, pp. 54 and 312.

Odontomyia amyris, Walker, List. Dipt. B.M., iii., 1849, p. 535. *Id.*, White, Proc. Roy. Soc. Tasm., 1914, p. 56. *Id.*, White, P.L.S. N.S.W., xli., 1916, p. 91. *Id.*, Hardy, Proc. Roy. Soc. Tasm., 1917, p. 62.

Odontomyia subdentata, Macquart, Dipt. Exot., suppl. 4, 1850, p. 49. *Id.*, White, Proc. Roy. Soc. Tasm., 1916, p. 260. *Id.*, White, P.L.S. N.S.W., xli., 1916, p. 92. *Id.*, Hardy, Proc. Roy. Soc. Tasm., 1917, p. 62.

Odontomyia rufifacies, Macquart, Dipt. Exot., suppl. 4, 1850, p. 51. *Id.*, White, Proc. Roy. Soc. Tasm., 1914, pp. 55, 56, and 74. *Id.*, White, P.L.S. N.S.W., 1916, p. 90.

Odontomyia marginella, Macquart, Dipt. Exot., suppl. 4, 1850, p. 52. *Id.*, White, Proc. Roy. Soc. Tasm., 1914, p. 57; and 1916, p. 260. *Id.*, White, P.L.S. N.S.W., xli., 1916, p. 93.

Odontomyia annulipes, Macquart, Dipt. Exot., suppl. 4, 1850, p. 52. *Id.*, White, P.L.S. N.S.W., xli., 1916, pp. 90 and 92.

Odontomyia picea, Walker, Ins. Saund. Dipt. i., 1850, p. 78. *Id.*, White, P.L.S. N.S.W., xli., 1916, pp. 90 and 100.

Stratiomys picea, Walker, List. Dipt. B.M., v. suppl. 1, 1854, p. 55.

Odontomyia kirchneri, Jaennicke, Abh. Senck. Nat. Ges., vi., 1867, p. 323.

Odontomyia pectoralis, Thomson, Eug. Resa, Dipt., 1869, p. 455.

Synonymy.—The above synonymy includes all descriptions that come within the probable variation of the common and widely dispersed species of *Odontomyia* previously known as *O. amyris*, Walker. When the types are examined together with a long series of new specimens,

this long list may be found to contain more than one species.

The scutellar spines of this species are identical with those of *O. carinifacies*, Macquart, and *O. sydneyensis*, Schiner, in the larger specimens, but smaller and distinctive spines are to be found in small specimens, and these range in size to normal spines, making it impossible to form specific differences on this character.

Traces of a tibial ring, often met with in other species, appear rare in *O. decipiens*, Guerin, and no value can be placed on this or the face colouration for identification purposes.

Guerin's description of *O. decipiens* is typical of the male described by White as *O. amyris*, Walker. There can be little doubt that it is correctly identified.

O. regisgeorgii, Macquart, is described from a mutilated specimen, and probably belongs here.

O. subdentata, Macquart, probably belongs here, and White's record for Tasmania certainly belongs here, but a specimen with the black carina described by Macquart is not known in any recent collection.

O. rufifacies, Macquart, undoubtedly belongs here.

O. marginella, Macquart, reads like that of *O. opertanea*, White, and differs chiefly in the underside of the abdomen and the legs. The black face makes it somewhat doubtful if the species is correctly placed here, but the "Thorax with light green reflections and yellow pile" and the "Scutellum with little spines" prevent it being identified with any of the other species known.

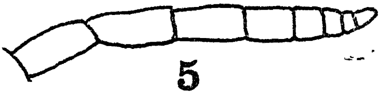
O. annulipes, Macquart, is distinctive in the two sexes, the male (like *O. marginella*, Macquart) reads similar to White's *O. opertanea*, and indeed may be identical with it, but the female is referable to the form described under the name *O. amyris*, Walker, by myself in 1917.

O. picea, Walker, apparently belongs here. White stated that the type in the British Museum is in too bad a condition for determination.

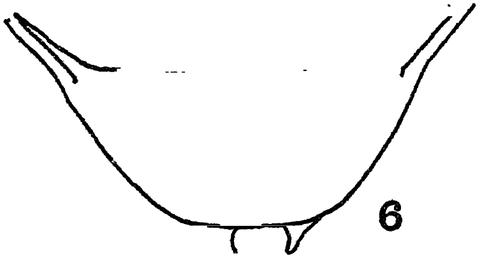
O. kerchneri, Jaennicke, and *O. pectoralis*, Thomson, were overlooked by White. Their descriptions conform to that of *O. decipiens*, Guerin.

Odontomyia opertanea, White.

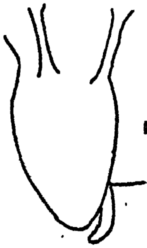
Text figs. 5, 6, and 7.



5



6



7

Odontomyia opertanea, White, P.L.S. N.S.W., xli., 1916, p. 93. *Id.*, Hardy, Proc. Roy. Soc. Tasm., 1917, p. 62.

Status.—I am indebted to Mr. C. E. Cole for the loan of a specimen of this species from Ringwood, Victoria, and this is identical with the Tasmanian specimens recorded in 1917.

Description.—The following description is taken from the Tasmanian specimens, and is supplementary to White's description :—

Female. The antennæ are longer than in the other Australian species; the two basal joints are equal, and together are almost as long as the third. The scutellar spines are small, inconspicuous, and placed under the scutellum instead of on the apical border.

It is a black species with slight tracings of golden tomentum on the head and the thorax, a small yellowish area round the oral opening, the legs and wing veins yellowish, the abdomen green ventrally, and dorsally bordered very narrowly green, which colour shows signs of turning yellow in places, in addition to which there is a pair of very small lateral spots confluent with the border on the 2nd, 3rd and 4th segments, and the apex of the halteres green.

Length.—7-8.5 mm.

Hab.—Tasmania: Cradle Mountain, two females, 17th January, 1917. Victoria: Ringwood, one female. New South Wales: Blue Mountains, one female in the Macleay

Museum. Western Australia: King George Sound, two females in the Macleay Museum.

Odontomyia pallida, Hill.

Odontomyia pallida, Hill, P.L.S. N.S.W., xliv., 1919, p. 456. Text figs. 4 a-b.

Status.—It is impossible without a proper description of the scutellar spines to ascertain if the relationship of this species is near *O. decipiens*, Guerin, which seems probable, as there is nothing in the description to separate it from that variable species.

Odontomyia obscura, Hill.

Odontomyia obscura, Hill, P.L.S. N.S.W., xliv., 1919, p. 457. Text fig. 5 a-b.

Status.—The illustration of this species conforms to *O. laterimaculata*, Macquart, and indeed the description reads remarkably similar to a variation of the same, but differs in some colour markings.

It is possible that this may be the long missing *O. hunteri*, Macleay, which probably came from somewhere on the northern coast of Australia, and also appears to conform to *O. laterimaculata*, Macquart.

Odontomyia hunteri, Macleay.

Stratiomys hunteri, Macleay, in King's Narr. Surv. Austr. ii., 1827, p. 467.

Odontomyia hunteri, White, P.L.S. N.S.W., xli., 1916, p. 92.

Status.—The type of this species apparently cannot be traced. A specimen corresponding to the description is not to be found in the Australian Museum nor the Macleay Museum, and it is advisable to hold over the identification until more material is available.

It could be *O. laterimaculata*, Macquart (as identified by White), which sometimes has only two basal pairs of spots present. White included the reference under his *O. amyris*, Walker, now *O. decipiens*, Guerin, stating that a rare form has two pairs of spots, but as no special colour is given for the face in the original description this would probably be black and not yellow.

The description of *O. obscura*, Hill, also conforms to the *O. laterimaculata* variety referred to above, and as Macleay's species probably came from somewhere on the northern coast of Australia it is possible that *O. obscura*, Hill, belongs here.

Odontomyia stricta, Erichson.

Odontomyia stricta, Erichson, Arch. f. Naturf., viii., i., 1842, p. 272. *Id.*, White, P.L.S. N.S.W., xli., 1916, pp. 90 and 100.

Stratiomys stricta, Walker, List. Dipt. B.M., v. suppl. 1, 1854, p. 55.

Status.—This description appears confused, and no specimen is known to agree with it. Possibly the description was taken from more than one species, which would account for the apparent mixture of characters.

Stratiomyia badius, Walker.

Stratiomys badius, Walker, List. Dipt. B.M., iii., 1849, p. 529; and iv., 1849, p. 1157. *Id.*, White, P.L.S. N.S.W., xli., 1916, p. 90 and 100.

Hab.—Walker first gave New Holland as the locality, and then changed it to New Hudson. This species is cancelled from the Australian list.

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EXPLANATION OF PLATE.

Fig. 1. Scutellum of *Ophiodesma flavipalpis*, Macquart.

Fig. 2. Scutellum of *Odontomyia scutellata*, Macquart, dorsal view.

Fig. 3. Scutellum of *Odontomyia scutellata*, Macquart, lateral view.

Fig. 4. Scutellum of *Odontomyia laterimaculata*, Macquart.

Fig. 5. Scutellum of *Odontomyia carinifacies*, Macquart, ♀ typical form.

Fig. 6. Scutellum of *Odontomyia carinifacies* var. *grandimaculata*, *var. nov.*

Fig. 6. Abdomen and scutellum of *Odontomyia carinifacies* var. *grandimaculata*, *var. nov.*

Fig. 7. Abdomen and scutellum of *Odontomyia carinifacies* var. *minima*, *var. nov.*

Fig. 8. Abdomen and scutellum of *Odontomyia decipiens*, Guerin, drawn from a small specimen.

Fig. 9. Abdomen and scutellum of *Odontomyia decipiens*, Guerin, drawn from a second small specimen.

Note.—All the above illustrations were drawn to the same scale.

A REVISED CENSUS OF THE TASMANIAN FLUVIATILE MOLLUSCA.

By W. L. May.

Plates IX.-XII.

(Read 12th July, 1920.)

On entering on a revision of the Tasmanian freshwater molluscs, the question naturally arises why should this be necessary, seeing the great amount of attention that has been given to this subject by a number of distinguished naturalists. The truth is that much overlapping has occurred in previous work, creating many synonyms, partly through ignorance, or uncertainty as to what previously described species really were, as they were usually not figured. Again, too much stress was laid on small variation in the erection of species, which variation proves to be individual, and not specific.

The earliest naturalists who touched this fauna appear to be Quoy and Gaimard, who in the Zoology of the Astrolabe, 1835, describe and figure *Paludina nigra* from D'Entrecasteaux Channel. Bourguegnat appears next by describing in Proc. Zool. Soc., 1854, our large freshwater limpet *Ancylastrum*. Reeve, in the Conch. Icon., 1857, described *Littorina paludinella*, subsequently described by Tenison-Woods as *Ampullaria tasmanica*, and now placed in the genus *Petterdiana*. Sowerby also in the Conch. Icon. described seven species of Physa, mostly sent him by Legrand; several of these species cannot be maintained. His *P. vandiemenensis* is almost certainly exotic, it is a large, conspicuous form, that has never been taken again, and was probably sent by Ronald Gunn, who is known to have made similar mistakes with a number of marine shells. The figure in Conch. Icon. looks very like some of the New Zealand forms. Von Martens in 1858 described *Hydrobia tasmanica*; this species was not identified by local workers, and consequently it was twice redescribed. Hedley P.L.S. N.S.W. for 1913 published a figure of *Amnicola diemense* Frauenfeld, which appears to be the same as Von Martens' figure of *H. tasmanica*. Frauenfeld also described, in 1863, *Hydrobia gunnii*, another species not recognised by local workers, and it has been several times redescribed. Hedley op. cit. gives a figure from the probable type in the

British Museum, from which it can be easily identified. Tenison-Woods was the first to work at these forms on the spot, and had a large amount of material placed in his hands by Legrand. Considering this naturalist's reputation, and opportunities, it is extraordinary how little value can be set on his work. Of 24 species of fluviatile shells described, only about six can be maintained as distinct species, but he must receive credit for partly admitting his errors, for when dealing with *Bythinella nigra* in these proceedings for 1879, pp. 71-72, he unites with it four of his supposed species. Of his four species of Lymnæa, *L. tasmanica* is admitted by himself, Proc. Roy. Soc. Tas., 1878, p. 72, to be founded on the introduced *L. peregra*, and the three others are probably variants of one native species (see Petterd, Journ. Conch. ii., p. 81). His six species of Physa all become sunk in synonymy. Fortunately a type series of these was mounted and placed in the Tasmanian Museum, Hobart. Many of these are broken, and some quite destroyed; of the four species and two varieties that remain I have prepared figures for this paper. Of *P. tasmanica*, one perfect specimen remains on the card, it seems conspecific with *P. pyramidata* Sowerby; var. a., the single specimen seems scarcely adult, it appears to equal *P. gibbosa* Gould; var. b., of five specimens mounted, one is the same as var. a.; probably the others are the same also, but in a more adult state. *P. ciliata*, four specimens, some rather broken; two are short spired, and practically identical with the last; two are long spired, resembling the next. *P. legrandi*, one large specimen, thin, and probably not quite adult, probably is a rather stout form of *P. pyramidata*. *P. huonensis*, four specimens have been mounted, but all are destroyed; Petterd, who probably saw the types, considered it equalled *tasmanica*. *P. huonicola*—no trace of this species seen, but the description would seem to bring it under *pyramidata*. *P. tasmanicola*, eight specimens have been originally mounted, of which one remains perfect. (Another specimen remaining is *Potamopyrgus tasmanica*). I consider this species undoubtedly a juvenile of *pyramidata*.

Our author was not more fortunate in dealing with the small Amnicola-like species in our streams. Three of his species are synonyms of *P. nigra*, and it is difficult to see with respect to two of them, viz., *B. legrandi* and *tasmanica*, how he could see any difference from *nigra*, or from one another. The same remarks apply to two other species, which become united to *P. gunnii*. Type series of these were also presented to the Museum, and

enough remained to enable a satisfactory identification and figure to be made. Two Pisidium and one Cyclas were also described, and *Valvata tasmanica*, now placed in Petterdiana. A very unsatisfactory feature of this description is that it is printed on a slip attached to page 82, P. and P. Royal Society, Tas., for 1875, immediately below *Cyclas tasmanica*; this is missing from the copy in the Royal Society Library, and may be from others. It may therefore be well to reprint the English portion of the original description, which is as follows:—

"Shell minute, globosely turbinate, deeply and widely umbilicate, pale horny, spotted with a blackish epidermis, rather solid, semi-pellucid; whorls 4, rounded, faintly undulately striate, subcanaliculate at the sutures; aperture semi-lunate, sub-reflexed, posteriorly angulate; inner lip straight and thin; umbilicus margined. Operculum horny, oval and subspiral, Long. 1, Lat. 1, millimeters."

W. F. Petterd, who is so well and favourably known for his work on the Tasmanian land shells, also gave considerable attention to the freshwater forms. He gives a very useful list of the species as then known in the Journ. Conch. ii., 1879, p. 80, with comments and some corrections. In his Contributions for a systematic catalogue of Aquatic shells in P. and P. Roy. Soc. Tas. for 1888, he dealt more thoroughly and completely with this group than any other worker; and at the same time described ten new species and several varieties, and published with the paper a large number of figures; many of these, however, especially of the smaller species, are very roughly executed, and are of little value for identification. Most of his types are now in the Launceston Museum, and I had an opportunity before they were placed there of examining them carefully, and figuring most. Of his two species of Lymnæa, *L. lutosa* is in my opinion only one of the common forms of *L. peregra* introduced from Europe. His *Potamopyrgus woodsi* equals *P. tasmanica* von Martens; his *Assiminia bicincta* is conspecific with *A. tasmanica*, Tenison-Woods, and his two minute species, *P. smithii*, and *P. dyeriana*, are somewhat doubtfully distinct from *P. gunnii*, of which they may be micromorphs.

Finally, R. M. Johnston, P. and P. Roy. Soc. Tas. for 1879, described *Gundlachia petterdi*, and *Ancylus woodsi*, the latter being the undeveloped form of the former, also an *Amnicola* and two *Planorbis*. Op. cit. for 1888, p. 84, appear critical observations on recent contributions to our knowledge of the Freshwater shells of Tasmania,

which are interesting, and accompanied by four plates of figures, tolerably well executed and numbered, but strangely he has omitted to provide an index to the numbers, so that identification is somewhat difficult. On page 95 of the same volume is a paper on the variability of our Tasmanian Unio, with a folding plate. Op. cit. for 1890 he published a list of the whole of the Tasmanian mollusca, and in dealing with *Physa* takes the drastic step of including all the species as synonyms of *P. nitida*, Sowerby, which is really a council of despair, although he was no doubt partly justified in so doing. He also lumps all the Planorbis together, which is unfortunate.

LIST OF SPECIES.

Family *Cycladidæ.*

Sphærium, Scopoli, Intra. ad. Hist. Nat. 1777, p. 397.

1. *macgillivrayi*, Smith, Pro. Linn. Soc., 1881, p. 305, pl. 7, f. 32. Hab.—Great Lake, Waratah, Flinders Island.

2. *tasmanicum*, Ten-Woods, Cyclas, P. and P. Roy. Soc. Tas., 1875, p. 82. Hab. East Coast, near Swansea, type; near Hobart, also Maria Island (Petterd); differs from the last, in being less round, and with more prominent umbos. Pl. IX., f. 1.

Pisidium, Pfeiffer, Land, Suggn. Moll. Deutsch. 1875, p. 82.

3. *dulvertonensis*, Ten.-Woods, P. and P. Roy. Soc., Tasm. 1875, p. 82. Type in Tasmanian Museum, Hobart. Hab. Lake Dulverton. Pl. IX., f. 2.

4. *tasmanicum*, Ten.-Woods, P. and P. Roy. Soc., Tasm. 1875, p. 82. Types in Tasmanian Museum, Hobart. Hab. Generally distributed. Pl. IX., f. 3.

Family *Unionidæ.*

Diplodon, Spix, Test. Fluv.

5. *australis*, Lamarck, Unio, Bras. 1827, p. 33; Var. legrandi Petterd, P. and P. Roy. Soc. Tasm., 1889, p. 81. Johnston, op. cit., p. 95, two plates; Stimpson, Pro. Nat. Mus., Smithsonian Inst., xxiii., 1900, p. 891.

6. *mortonicus*, Reeve, Unio, Conch. Icon. XVI., 1865, f. 118. Lea, Syn., 1870, p. 43. Stimpson, op. cit. Hab. It is remarkable that the genus in Tasmania is entirely confined to rivers flowing into Bass Strait.

Family *Limnæidæ*.

Amphipeplea, Nilsson Hist. Moll. Succ., 1822, p. 58.

7. *huonensis*, Ten.-Woods, Limnæa, P. and P. Roy. Soc. Tasm., 1875, p. 71=*hobartonensis*, Ten.-Woods, op. cit.=*launcestonensis*, Ten.-Woods, op. cit., Petterd Journ. Conch. ii., 1879, p. 81; Proc. Roy. Soc., Tasm. for 1888, p. 65, pl. 2, f. 11. Tate, Proc. Roy. Soc. Tasm., 1884, p. 214; Petterd, op. cit. gives reasons for the above synonymy; Ten.-Woods P. and P. Roy. Soc. Tas., 1878, p. 72, says *hobartonensis*=*L. peregra*. Nelson, Journ. Conch. ii., 1879, says the same.

Limnæa, Lamarck, Mem. Soc. Nat. Hist., 1799, p. 75.

8. *gunnii*, Petterd, P. and P. Roy. Soc. Tas., 1888, p. 66, pl. 2, f. 10. Hab. South Esk River, near Launceston. The author remarks that the animal at once separates it from the last species.

9. *subaquatilis*, Tate, var. neglecta, Petterd op. cit. p. 66, Pl. 2 f. 13. Hab.—In Tea Tree swamp, near Launceston.

Bullinus, Oken. Lehrb., 1815, p. 303.

10. *apertus*, Sowerby, Physa, Conch. Icon. Pl. 11, f. 88, a.b. Hab. Creeks between Hamilton and New Norfolk, Tasmania, also the vicinity of Launceston and the Great Lake. Typically. very rounded in outline, but variants bring it sensibly near the shorter forms of *pyramidata*.

11. *gibbosus*, Gould, Physa, Proc. Boston Nat. Hist. ii., 1847, p. 214, Sowerby, Conch. Icon, f. 27. Smith, Journ. Linn. Soc. XVI., 1881, p. 278, pl. 6, f. 3-4 ? = *nitida*, Sowerby, op. cit. pl. 12, f. 89=*tasmanica*, var. a. Ten.-Woods, P. and P. Roy. Soc., Tas, 1875, p. 75, Pl. IX., fig. 4=*tasmanica var. b.* Ten.-Woods, op. cit. Pl. IX., f. 5. These varieties are probably *gibbosus* in a rather juvenile state=*ciliata*, Ten.-Woods, op. cit. p. 75, of the four specimens mounted on the type card, two seem to be of this species, and two, Pl. IX., f. 6, may possibly be juvenile of the next species. Hab. widely distributed, but overlooked or attributed to other species, near Waratah, Bruny Island, etc.

12. *mamillatus*, Sowerby, *Physa*, Conch. Icon. pl. 12, f. 90. ?=*ciliata*, Ten. Woods, pars. This species is separated from *P. attenuatus*, Sowerby, from the same locality, by its remarkable mucronate apex, but intermediaries may yet be found. Hab. Lake Dulverton, near Oatlands.

13. *pyramidatus*, Sowerby, Physa, Conch. Icon, f. 62. Smith, Journ. Linn. Soc. XVI., 1881, p. 282, pl. 6, f. 17.

=*eburnea*, Sowerby, op. cit. f. 89.

=*attenuata*, Sowerby, op. cit. f. 94.

=*bruniensis*, Sowerby, op. cit. f. 99, juvenile.

=*huonensis*, Ten. Woods, Pro. Roy. Soc. Tasm. for 1875, p. 74.

=*legrandi*, Ten. Woods, op. cit. Pl. IX., f. 7.

=*tasmanica*, Ten. Woods, op. cit. Pl. IX., f. 8.

=*tasmanicola*, Ten. Woods, op. cit. p. 75, juvenile, Pl. IX., f. 9.

= ? *huonicola*, Ten. Woods, op. cit.

Johnston, P. and P. Roy. Soc. Tas., 1890, p. 145.

The common and variable form, universally distributed, differing greatly in colour, size, and length of spire. The type of *pyramidatus*, was from Flinders Island, and Smith's figure agrees fairly well with our ordinary specimens as *eburnea* and *tasmanica*; *bruniensis*, and *tasmanicola*, I consider undoubtedly juvenile, *attenuata* may possibly be a variant of *mamillatus*.

Family *Planorbidiæ*.

Planorbis, Geoffroy, Traite, Coq. 1767, p. 12.

14. *atkinsoni*, Johnston, P. and P. Roy. Soc. Tas., 1878, p. 26. Petterd, op. cit. for 1888, p. 68, pl. 2, f. 6-7. Whorls more rapidly increasing, and more strongly keeled, than the next, but closely allied. Hab. South Esk River, from Avoca to Launceston. Pl. X., f. 10.

15. *meridionalis*, Brazier, P.L.S. N.S.W., 1875. Petterd, P. and P. Roy. Soc. Tas., 1888, p. 67, Pl. 1, f. 4-6. Hab. Upper Ouse River, type; Great Lake. Pl. X., f. 11.

16. *scottiana*, Johnston, P. and P. Roy. Soc. Tas., 1878, p. 26. op. cit. for 1888, pl. 6, f. 2 a.b.c. Hab. South Esk River. Very distinct from our other species. Pl. X., f. 12.

17. *tasmanicus*, Ten. Woods, P. and P. Roy. Soc. Tas., 1875, p. 79. Petterd, op. cit. p. 68, pl. 2, f. 8-9. Hab. Swamps at Circular Head. Pl. X., f. 13, 14.

Segmentina, Flemming, Hist. Brit. Animals, 1838, p. 279.

18. *victoriæ*, Smith, Journ. Linn. Soc., XVI, 1881, p. 296, pl. 7, f. 11-13. May, P. and P. Roy. Soc. Tas. 1919, p. 69. Hab. Lake Tiberias.

Family *Ancylidæ*.

Ancylus, Geoffroy, Trait, Coq. 1767, p. 13.

19. *mariæ*, Petterd, P. and P. Roy. Soc. Tas., 1900, p. 1. Hab. Maria Island, possibly a variant of the next.

20. *tasmanicus*, Tenison Woods, P. and P. Roy. Soc. Tas., 1875, p. 70. Hab. Common in streams near Hobart. Pl. X., f. 15-16.

Ancylastrum, Bourguignat, Jour. de Conch. IV., 1853, p. 63 and 170.

21. *cumingianum*, Bourguignat, Proc. Zool. Soc., 1854, p. 91. Hedley, Pro. Malac. Soc. 1, 1894, p. 118. Ten. Woods, P. and P. Roy. Soc., Tas., 1875, p. 69. Hab. Streams above New Norfolk, also Great Lake. Var. *irvinæ* Petterd, P. and P. Roy. Soc. Tas., 1887, p. 40, pl. 44. Hab. Great Lake.

Gundlachia, Pfeiffer, Zeits, Malak, VII., 1849, p. 98.

22. *petterdi*, Johnston, P. and P. Roy. Soc. Tas., 1878, p. 23, 1884, p. 216, for 1888, figs. 2, a.b.c. Hab. In a pool near First Basin, Launceston = *Ancylus woodsi*, Johnston, op. cit., 1888, p. 25 = *G. beddomei*, Petterd, op. cit., 1887, p. 41, pl. 44, Journ. de Conch, IV., p. 180. Johnston, op cit. for 1888, pl. facing p. 86. Hedley, P.L.S., N.S.W., 1894, pp. 905-914, pl. 24, f. 1-15. Hab. Old quarry, Brown's River-road. *woodsi* is the immature form. I feel satisfied we have only one rather variable species.

Family *Hydrobiidæ*.

Potamopyrgus, Stimpson, Am., Journ. Conch 1, 1865, p. 53.

23. *brownii*, Petterd, P. and P. Roy. Soc. Tas., 1888, p. 72, pl. 3, f. 14. Hab. Rivers on the North-East Coast. Pl. X., f. 17.

24. *dyeriana*, Petterd, Bithynia, Journ. Conch, 1879, p. 86. Hab., Long Bay. Possibly a micromorph of the next. Pl. X., f. 18.

25. *gunnii*, Frauenfeld, Hydrobia, Verh. Zool. Bot. Gesill Vienna, xiii., 1863, p. 1025, and xv., 1865, p. 526, pl. 7, 2 figs. Hedley, P.L.S. N.S.W., 1913, p. 283, pl. 17, f. 51. = *A. simsoniana*, Brazier, P.L.S. N.S.W., 1875, p. 76. = *pontvillensis*, Ten.-Woods, P. and P. Roy. Soc. Tas., 1875, p. 76; pl. XI., f. 19 = *dunrobinensis*, Ten. Woods, op. cit. p. 77. Pl. XI., f. 20. Streams, lagoons, and ponds, particularly in the South-East. I think a study of the figures cited above will support the foregoing synonymy.

26. *elongatus*, Sp. Nov. Shell narrowly elongate, colour, dull brownish black on the spire, shining light brown on the body whorl, finely axially striate, whorls 6½, much rounded, suture well impressed. Aperture roundly ovate, lip entire, backed by a distinct umbilical chink. Long. 3, Lat. 1 mill. Hab. Apsley River, near Bicheno, collected by E. Mawle. It is with some diffidence that I add another member to this over-described genus, but I cannot match the species with any of the others. It comes nearest to *P. gunnii*, but it is much longer, and narrower, with very rounded whorls. The habitat is a small isolated river on the middle East Coast. Pl. XI., f. 21.

27. *marginata*, Petterd, P. and P. Roy. Soc. Tas., 1888, p. 73, pl. 1, f. 9. Hab. Stream near Heazlewood River. Very distinct from all our other species. Pl. XI., f. 22.

28. *nigra*. Quoy and Gaim. Zool. Astrolabe, iii., 1835, p. 174, pl. 38, f. 9-12. Hab. D'Entrecasteaux Channel.

=*B. legrandiana* and *wisemanniana*, Brazier, Proc. Zool. Soc., 1871, p. 678. Pl. XI., f. 23.

=*B. petterdiana*, Brazier, P.L.S. N.S.W., 1, 1875, p. 19.

=*legrandi*, Ten. Woods, P. and P. Roy. Soc. Tas., 1875, p. 76. Pl. XI., f. 24.

=*unicarinata*, Ten. Woods, op. cit. Pl. XI., f. 25.

=*tasmanica*, Ten. Woods, op. cit. p. 77. Pl. XI., f. 26.

=*exigua*, Ten. Woods, op. cit. for 1878, p. 71, op. cit. 1879, p. 71-72.

Petterd, op. cit. for 1888, p. 69-71. Widely distributed in rivers and creeks, both North and South.

29. *smithii*, Petterd, Proc. Roy. Soc. Tasm. for 1888, p. 72, pl. 1, f. 10. Hab. Rivers of the North-West, Heazlewood, Arthur, Waratah, and Castray Rivers. Perhaps only a large form of P. *dyeriana*. Pl. XI., f. 27.

30. *tasmanica*, von Martens, Hydrobia, Weig. Arch. Nat. Sci., 1, 1858, p. 185, pl. 5, f. 12=*A. diemense*, Frauenfeld, Verhandl. Zool. Bot. Ges. Wien, XV., 1865, p. 529, pl. X, 2 figs. Hedley, P.L.S. N.S.W., xxxviii., 1913, p. 284, pl. 17, f. 52=*B. dulvertonensis*, Ten. Woods, P. and P. Roy. Soc. Tas., 1875, p. 77. Pl.

XII., f. 28=*woodsi*. Petterd, op. cit. for 1888, p. 71, pl. 1, f. 12=*P. victoriæ*, Ten. Woods. Pl. XII., f. 29. I possess a copy of Martens' fig 12, and it completely justifies the above synonymy. Hab. principally in the Northern Rivers.

31. *turbinata*, Petterd, Hydrobia, P. and P. Roy. Soc. Tas., 1888, p. 77, pl. 2, f. 3. Hab. R. Styx, and George's River, East Coast. Pl. XII., f. 30.

Petterdiana, Brazier, P. and P. Roy. Soc. Tasm. for 1895, p. 105.

32. *bellii*, Petterd, Beddomeia, P. and P. Roy. Soc. Tasm. for 1888, p. 75, pl. 1, f. 7. Hab. Heazlewood, Castray and Waratah Rivers. Pl. XII., f. 31.

33. *hullii*, Petterd, Beddomeia, op cit. p. 76, pl. 1. f. 8, Hab., with the last, doubtfully distinct from *lodderæ*. Pl. XII., f. 32.

34. *launcestonensis*, Johnston, Amnicola, P. and P. Roy. Soc., Tas., 1878, p. 24. Petterd. op. cit. p. 74, pl. 1, f. 2. Hab. South Esk River. Pl. XII., f. 33. Var. *A. tumida*, Petterd. op. cit. Hab., Great Lake, a large form.

35. *lodderæ*, Petterd, Beddomeia, op. cit., p. 75, pl. 3, f. 1. Hab., Castra and Duck Rivers, N. Coast. Pl. XII., f. 34.

36. *paludinella*, Reeve, Littorina, Conch. Icon., 1857, pl. 16, f. 84=*Ampullaria tasmanica*, Ten. Woods, Proc. Roy. Soc. Tasm. for 1876. p. 117, and 1878, p. 72. *Brazieria tasmanica*, Petterd, op. cit. p. 76, pl. 1, f. 1. Johnston, P. and P. Roy. Soc. Tas., 1879, p. 24. Hedley, P.L.S. N.S.W., xxxviii.. 1913, p. 283. Hab. The Wye and other tributaries of the Waratah and the Arthur Rivers. Pl. XII., f. 35.

37. *tasmanica*, Ten. Woods, *valvata*, P. and P. Roy. Soc. Tas., 1875, p. 82 (attached). Petterd, op. cit., p. 75, pl. 1, f. 11. Hab. Small stream in Gould's Country. Pl. XII., f. 36.

EXPLANATION OF PLATES.

Plates IX-XII

Fig. 1. *Sphærium tasmanicum*, Ten. Woods (Cyclas), from Petterd's specimen.

Fig. 2. *Pisidium dulvertonensis*, Ten. Woods, from type.

Fig. 3. *Pisidium tasmanicum*, Ten. Woods, from one of the type series.

Fig. 4. *Physa tasmanica*, var A. Ten. Woods, from the type.

Fig. 5. *Physa tasmanica*, var. B. Ten. Woods, from one of the type series.

Fig. 6. *Physa ciliata*, Ten. Woods, from one of the type lot.

Fig. 7. *Physa legrandi*, Ten. Woods, from the type.

Fig. 8. *Physa tasmanica*, Ten. Woods, from the type.

Fig. 9. *Physa tasmanicola*, Ten. Woods, from the type.

Fig. 10. *Planorbis atkinsoni*, Johnston, from Petterd's specimen, compared with the type series.

Fig. 11. *Planorbis meridionalis*, Brazier, from Petterd's co-type.

Fig. 12. *Planorbis scottiana*, Johnston, from Petterd's specimen compared with the type series.

Fig. 13, 14. *Planorbis tasmanicus*, Ten. Woods, from specimens compared with the type series.

Fig. 15, 16. *Ancylus tasmanicus*, Ten. Woods, from one of the type series.

Fig. 17. *Potamopyrgus brownii*, Petterd, from one of the type series.

Fig. 18. *Potamopyrgus dyeriana*, Petterd, from one of the type series.

Fig. 19. *Potamopyrgus pontvillensis*, Ten. Woods (Bythinia), from one of the type series.

Fig. 20. *Potamopyrgus dunrobinensis*, Ten. Woods (Bythinia), from one of the type series.

Fig. 21. *Potamopyrgus elongatus*, May, from the type.

Fig. 22. *Potamopyrgus marginata*, Petterd, from one of the type series.

Fig. 23. *Bythinia legrandiana*, Brazier, from Petterd's specimen.

Fig. 24. *Bythinia legrandi*, Ten. Woods, from one of the type series.

Fig. 25. *Bythinia unicarinata*, Ten. Woods, from one of the type series.

Fig. 26. *Bythinia tasmanica*, Ten. Woods, from one of the type series.

Fig. 27. *Potamopyrgus smithii*, Petterd, from one of the type series.

Fig. 28. *Bythinia dulvertonensis*, Ten. Woods, from one of the type series.

Fig. 29. *Potamopyrgus woodsi*, Petterd, from one of the type series.

Fig. 30. *Hydrobia turbinata*, Petterd, from one of the type series.

Fig. 31. *Beddomeia bellii*, Petterd, from specimen compared with the type.

Fig. 32. *Beddomeia hullii*, Petterd, from specimen compared with the type.

Fig. 33. *Amnicola launcestonensis*, Johnston, from Petterd s specimen.

Fig. 34. *Beddomeia lodderæ*, Petterd, from specimen compared with the type.

Fig. 35. *Ampullaria tasmanica*, Ten. Woods, from Petterd's specimen.

Fig. 36. *Valvata tasmanica*, Ten. Woods, specimen from type locality.

STUDIES IN TASMANIAN MAMMALS, LIVING AND EXTINCT.

Number III.

Nototherium mitchelli. *

Its evolutionary trend—the skull, and such structures as related to the nasal horn.

By

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and

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Plates XIII. - XXI.

(Read 9th August, 1920.)

INTRODUCTION.

In a previous contribution we have traced the history of the Genus *Nototherium*, and have also described the osteology of the cervical vertebræ. As a natural sequence we now desire to place on record certain data gathered from a detailed examination of the skull itself. Before proceeding further, however, it might be as well if we explained our aims as regards the work generally.

A wonderful and most interesting group of marsupial animals has died out in our immediate zoological province, and as the remains available to us are superior in point of preservation to anything obtained in other parts of Australia, we are tempted to pay more attention to phyletic than taxonomic data. If all the *Nototherian* remains in the world were collected to a single centre, many, if not most, of the accepted genera and species would be found unnecessary for their adequate display as a single scientific collection. Accordingly, we are less interested in the ultimate fate of any species than we are in the elucidation of such facts as relate the racial history, development, and extinction of the *Nototherian* stirp. The phyletic trend of the stirp we are investigating was apparently towards the production of an aggressive race, and even a super-

* The specimen described was found in the Mowbray Swamp, near Smithton, N.W. Tasmania, in 1920, by Mr. E. C. Lovell. Mr. K. M. Harrisson made an arrangement with Mr. Lovell whereby the specimen was presented to the Tasmanian Museum. Tasmanian scientific institutions have benefited considerably owing to Mr. Harrisson's interest in their welfare.

ficial study of the subject has revealed various osteological parallels, with the similar trend in ungulates, a table of which we hope to supply later on, by way of a recapitulation of the several facts that may be noted in passing. Owing to the imperfection of our knowledge respecting the larger pleistocene mammals of the Genera *Procoptodon*, *Palorchestes*, *Thylacoleo*, etc., it is at present quite impossible to say how fully this combative trend developed before racial extinction became an accomplished fact, but that such mighty creatures (all powerfully clawed), if not otherwise armed, escaped the tendency to aggression, is, to say the least of it, unlikely. A modern Forester Kangaroo (*M. giganteus*), when at bay, is a fearsome beast, and a *Palorchestes*, or a *Procoptodon*, with their extra weight of body and limb, must have been fighting units of no mean order. A little modern Wombat, when stirred up to a pitch of anger, has been seen to bite and lacerate the hand of a child in an exceedingly severe manner, causing one to wonder what a similar performance upon the part of an excited *Phascolonus* would have amounted to! The unenviable reputation of the *Cuscuses* in the alleged circumstances of their predatory instincts, enlarged with a body bulk to that of *Thylacoleo*—although it might not produce the "public executioner" of former disputes, would certainly add its quota to the marsupial battlefield in an effective manner, especially when we remember that the whole construction of *Thylacoleo*, as far as we know it, indicates speed. Manifestly, until the whole history of the pleistocene giants has been worked out from associated bones, rather than—as at present—listed, and cross-listed, from isolated fragments, it will be quite impossible to do more than suggest possibilities; but, if the swamps of Tasmania continue to yield up such evidence as has come to light since the year 1910, the day of exact knowledge should not be a distant one. It has been argued that the *Diprotodon* was as harmless as a *Tapir*, but even Tapirs in a captive state have been noted to quite suddenly manifest "fits of irritation, plunging about, lunging "violently with their heads, and snapping with their "teeth"; while in a state of nature, it is said of the American Tapir—"when hard pressed it defends itself "vigorously with its teeth, inflicting terrible wounds." As the skull of the *Diprotodon*, according to the late Professor Stirling (1), is still a matter of speculation, in various parts of its osteology, it is obvious that some hitherto unsounded notes are yet to be heard before we can close the octave of that creature's story. Certainly

(1) Monograph of *Phascolonus*. Roy Soc. S. Aust., 1913, p. 177.

no man upon earth knew more of *Diprotodon* than Doctor Stirling did, so if the skull, *in toto*, was unknown to him, we can with confidence conclude that an uncrushed specimen would reveal new truths to us.

THE OSTEOLOGY OF THE NASAL PLATFORM.

That the wonderfully supported, and under-propped nasal platform of the *Nototherian* skull was indicative of a nasally implanted weapon, was first suggested by Professor D. M. S. Watson, M.Sc., of the University College, London (2). To the objection that the nasal and cervical regions of *Nototherium tasmanicum* were too weak to have sustained any serious shock, Professor Watson, contended that the weapon might have taken the form of a pair of nasal bosses. With the discovery of the skull and parts of the skeleton of *Nototherium mitchelli*, all objections to the former existence of a nasal horn were immediately removed—since the more solidly built cervicals, wider and stronger nasal platform, and manifestly superior deposition of bony matter upon the nasal regions generally, spoke eloquently of the fact. The taxonomists of past days made features of the extent to which the nasal bones covered the nasal aperture, but as will now be shown, except in the most perfectly preserved crania, this character is not to be trusted, since the nasal cartilage was attached to the nasal bones in a manner wholly peculiar, and as we said in our original note, as an obvious adaptation to the special needs of the case. In *Nototherium mitchelli*, the ends of the nasal bones are 25 mm. thick, and upon either side of the middle line the thickness of this bone is first scooped out into a deep fossa, and then filled in with a bony stud, capable of movement within the fossa! A popular illustration of the result thus obtained would be found in the rotation of a bagatelle ball, in its cup-shaped socket upon the board. We can note grades of this adaptation in the following connection:—*Nototherium mitchelli* was a square mouthed animal, but, unlike the square mouthed rhinoceros of today, had front teeth and well-developed fangs. Such fangs, when in use, would need to be set free from the heavy overhanging lip (3), and as the distance between the end of the nose and the base of the horn was a short one, a fixed nasal cartilage would not have permitted of

(2) *Vide* Monograph of *Nototherium tasmanicum*, page 42, *et seq.*

(3) The extent of this lip may be gathered from the fact that the pre-alveolar extension of the tusks, from that process, to the gum line, amounts to 45 mm., practically a basal attachment for an incipient trunk.

such an action, hence the hinging of the cartilage itself. We do not imagine that any great extent of motion was thus obtainable in actual practice, but enough to give mobility to the upward pull of the ringentes muscles. In animals of the long faced type (to be defined fully later on), the nasals bent downwards, the horn was weak, and for practical purposes, but slightly developed, and so implanted as to leave the nasal cartilage freer from the stiffening effects of its contact with the nasal platform, and the origin of the lip, and accordingly the studs lost most of their motion, and may, in individual cases, have ankylosed up to the walls of their respective fossa, of which we are not without actual proof. The only other instance that we can recall in which the nasal cartilage was possibly attached to the bones by a bony stud is that of the South American *Mylodon*. In that extinct pleistocene giant, the terminal section of the united nasal bones develops a single, central, circular fossa, which, by analogy, suggests a condition similar to that found in *Nototherium*. If the stud existed in *Mylodon*—and apparently it has never been found, as is not to be wondered at if it was as loose as the studs are in the *Nototheria*—it was single and central, and not double and lateral. In Owen's Monograph upon the *Mylodon*, the fossa noted is beautifully shown (4), the appearance being exactly similar to that obtaining in *Nototherian* skulls, when the studs have dropped out. Now a fossil *Nototherian* skull, having once lost its nasal studs, would, with every mutilating movement, suffer attrition of the walls of the fossæ, until the real outline of the tips of the nasal bones would be effectively masked. Taxonomists should note this point! It is known that, irrespective of accidental rending of the horn from its platform, in modern rhinoceroses the horn itself is completely shed, and renewed every six years, and when so shed, animals frequently forget its loss and butt their tender nasal regions in attempting to horn a foe. If the horn was similarly deciduous in the *Nototheria*, they would still have their tusks available during the period of their renewal, and the extra mobility of the lips would serve a special purpose here. Our animal was just reaching the adult stage (as a mass of evidence can prove), and in the full power of its strength it had engaged in a desperate battle with some foe, lost its horn, broke the collar bone in half, shattered one mandibular tusk, and otherwise sustained minor wounds, that eventually led to its death, apparently some weeks later. The period that elapsed between the great fight and the time it actually

(4) Pl. 5, fig. 3a.

succumbed to its wounds is exactly that required to effect the amount of repair manifested by the broken clavicle, which, by estimation, is only a few weeks at the outside. A very careful examination of the skull and skeleton was made prior to removal from the matrix, especially the skull, and the conviction was formed that the horn had been lost prior to the animal's inclusion into the shallow mud of the old lake floor. Now the horn was an epidermal structure, and just what effect the chemical action of the marcasite and peaty marl would have had upon it is not easy to say, but as seemingly soft wood, in the form of roots of trees, manage to survive, and impress the matrix with their outlines, some little indication of it might have been expected had the weapon remained *in situ*. We most carefully removed all the mud with our hands from the nasal regions (without lifting the skull), and no indication of the fighting weapon rewarded our search, and accordingly we concluded that the horn had been torn from its platform prior to the animal's death. In the modern rhinoceros this also happens, in extreme cases, one instance being cited in which a rhinoceros drove its horn through the side of an elephant, tore the horn off, and both rhinoceros and elephant died.

THE NASAL HORN.

If a card of the shape shown in our illustration (fig. 1) is cut out and placed upon the nasal platform of the skull of *Nototherium mitchelli*, it will exactly cover the area that might be presumed to form the attachment surface for the base of the nasal horn. Its central portion would be cut equatorially by the naso-nasal fossa (C), and its right and left frontal aspects, by two nutrient foramina (A, B). Working backwards upon the skull, we discover that the ecto-carotid artery was immense, and prior to sending forward its maxillary branch, gave up some twigs to the vertex, as though to nourish a second, small horn, for which a frontal resting-place exists. After passing the ant-orbital canal, the internal maxillary artery ramified over the face, one portion going to supply the enormous nasal septum and cartilage generally, a second entered the nasal cavity, either in a distinct bony groove, or, in some skulls, more plexiform, over the bony roof of the nose, eventually passing upwards through the naso-nasal fossa to feed the base of the horn. While a third branch, seemingly the homologue of the *lateralis nasi*, went through the lateral groove in the nasal boss, to supply the horn with nourishment, and therefore means of repair.

It is an interesting fact that the horns of existing Rhinoceroses are strengthened and repaired along the front and fronto-lateral surfaces, to compensate for wear and tear, just as in the *Nototheria*, but apparently to a less degree, centrally, than obtained in the horned marsupials. If all the known Rhinoceros horns are passed in review, upon the question of size, ratio of base to height, as well as outline in girth, the card from the nasal platform of *Nototherium mitchelli* would nearest fit the base of an Indian Rhinoceros's horn; and if selection among such horns, upon a ratio of height to base-girth, were made, the height of the *Nototherian* horn would be nine to ten inches. As note—computed girth; deduced from available platform space, fourteen inches, average height of a horn of such girth, nine to ten inches. As some Rhinoceros horns have a distinct cingulum near the base, above which they contract in girth rapidly, this circumstance should be taken note of, also the fact that although practically adult, our *Nototherium* was still a young animal, and the nasal weapon would certainly be shorter than in an old male, who had many times shed and renewed it.

It will be convenient to give here the comparative thicknesses of the nasal bones of the two best-known *Nototherian* skulls, namely, *Nototherium mitchelli* and *Nototherium tasmanicum*, since nothing else short of a comparative examination of the actual skulls themselves will convey to the mind the extra massiveness of *Nototherium mitchelli*.

TABLE OF CALIPERED THICKNESSES OF *NOTOTHERIAN* NASAL PLATFORMS.

N. tasmanicum.		*N. mitchelli.*	
Thickness of right nasal boss	=42 mm.	Thickness of right nasal boss	=60 mm.
Thickness of left nasal boss	=41 "	Thickness of left nasal boss	=59 "
Central thickness of general nasal platform	=21 "	Central thickness of general nasal platform	=25 "
Thickness, at base, of nasal cartilage stud*	=22 "	Thickness, at base, of nasal cartilage stud	=22 "
Thickness of platform midway between the stud and the lateral nasal boss	= 7 "	Thickness of platform midway between the stud and the lateral nasal boss	=16 "
Width of nasals *in toto*	=138 "	Width of nasals *in toto*	=175 "

* In this skull the right stud has fused to the nasal, and is drawn out to a thinness of 17 mm. at the tip.

The female of *N. mitchelli* (Owen's cast, and type skull of *Zygomaturus*), while exceeding all the measurements of *N. tasmanicum*, falls short of those of the assumed male in about the same proportions as usually exist between male and female skulls. Not having the actual skull to work upon, we omit various details, but the cast and a series of photographs, supplied by the Curator of the Australian Museum, are available to us, and a careful study of these leads us to formulate the above statement. As a single note, expressing the rate of reduction, we may cite the widths of the nasal platforms. In the male, the measurement is 175 mm., but in the female this suffers diminution to 150 mm. A glance at the outlines of the implantation surfaces available in the male and female skulls, as given in our figure, will also show that if a horn existed in the female (as apparently it did) it advanced more upon the nasal aperture than that of the male did. In other words, the tips of the nasals were carried nearly across the narial aperture, and the anterior surface of the horn touched the tips of the nasals. This gives an outline for the base of the horn that makes a distinct departure from that obtaining in the male. Such differences in modern Rhinoceroses might also be cited, and where the horn is long, slender, and pointed forward, the females use it to direct the young, the latter being always in advance of the mother when on the march. As long as the female skull of *Nototherium mitchelli* alone remained available for study, the existence of a horn would only have been suggested as a possibility, but the male skull from Smithton carries it forward to the cogency of a proof. Again, *Nototherium tasmanicum*, viewed as an isolated factor, that manifested an elaborately underpropped nasal platform, too weak to carry an effective fighting weapon, and no excess of cervical power, suggested nothing more than the "fighting bosses"—postulated by Professor Watson—and accordingly it was only with the acquisition of the male skull of *Nototherium mitchelli* that the stirpian homologies determined their full significance. Professor Watson's suggestion is, today, so obviously close to the truth, that it is practically a demonstration of actual fact, and we herewith record our thanks for the strong sidelight thus thrown upon an obscure palæontological point.

It will now be necessary, in order to deal with the question of sex among the *Nototheria*, to show that the type skull of *Zygomaturus* (and Owen's cast) is the female of *N. mitchelli*, and not the sex variant of *Nototherium tasmanicum*, nor is that latter the sex variant of the skull

we call the male of *N. mitchelli*—in a word, *Nototherium mitchelli*, male and female, are quite distinct from *Nototherium tasmanicum*, and as a full table of characters will be given, it is only needful here to investigate the question of the presence and absence of a parietal crest. De Vis made much of this, and it seems a good point to investigate, especially as we can appeal to Kangaroos, Wombats, and Native Bears, among existing marsupials, and to the *Diprotodons*, and the various *Nototheria*, among extinct forms. Exactly what the ancestor of the common group may have shown in the connection we cannot, of course, say, but for a working hypothesis, let us assume a more or less rounded parietal region, with an interparietal bone that formed a section of the calvarium, and divided the parietals upon the median—sagittal—suture.

How, it may be asked, does this fit in with the conditions obtaining in the animals already named?

1. In the Kangaroo, the cranium is rounded, the interparietal, in early life, appears upon the surface, separates the parietals, and throws a dart forward into the sagittal suture. Two muscular lines bound the suture, starting as closely together as 2 mm., and opening outwards to 8 mm. at the frontal suture. At maturity this becomes a bony strip-like platform, slightly elevated above the parietals and frontals.
2. The Wombat starts life with a rounded cranium, a very small interparietal, that early fuses with the supra-occipital, two muscular lines (26 mm. apart, at the occiput, and 35 mm., at the frontal suture) outline the future platform, that characterises the Wombat's skull at maturity.
3. In the Native Bear, the interparietal early fuses with the supra-occipital, but continues to carry forward its full complement of bony matter, dividing the parietals, by its shield-shaped interposition, to a distance of 8 mm., for the first 18 mm. of their journey forward, upon the roof of the skull. Thence forward to the frontals, the parietals develop a sagittal crest (at maturity) and ancestoral bounding lines in early life.

In all these, the platform, or the strongly marked crest, as the case may be, is elaborated in the method shown from the ordinary ancestoral cranial elements—and a platform never becomes a crest, or a crest a platform, as a sexual modification in the mature animal, whatever slight changes may obtain in early life. Accordingly, the

crested *Nototheria* are made a distinct group of, and not regarded by us as possible sexual skull variations.

To close this comparative study, we must now recall the stages outlined above, and see how they agree with the conditions found in the extinct *Nototheria* and *Diprotodons*.

1. The Kangaroo best agrees with *Diprotodon*.
2. The Wombat's cranial platform is most closely simulated by *Nototherium mitchelli*, in both sexes, to a slightly variant degree. There are, however, traces of the primitive state in which the interparietal interposed, as in the Kangaroo and Native Bear. This, however, is only visible under a lens.
3. The crest of the Native Bear is found in *Nototherium tasmanicum*, in which skull the whole of the shield-shaped interparietal area has become an open fossa for the implantation of a moiety of the ligamentum nuchæ, and accordingly, the crest arises at the occipito-parietal ridge, as the direct result of the suppression of the interparietal from its true ancestoral position, as a moiety of the vertex.

In our section devoted to the taxonomy of the groups, we shall deal fully with the relationships of the several known and recognised *Nototheria*—the present note, however, being osteological, was best interpolated here.

As Professor Owen's description of the *Nototherian* skull covers so much ground, we shall only add such items as his material did not permit of passing in review.

THE PALATE, ETC.

The whole palate is, in essence, that of the Hairy-nosed Wombat, and is not so closely allied to that of the Tasmanian Wombat—namely, the prepalatine fossa is the same, although less deeply impressed, and the second pair of molars are not carried inwards upon the palate, but remain practically in the same alveolar curve as their fellows.

The total length of the bony palate is 305 mm., and that of the tooth line—175 mm. The widths between successive teeth, measured between the centres of the teeth named, are as follows:—

Between	Premolars	(centres)	... ...	55 mm.
,,	Molars I.	,,	... ...	64 ,,
,,	Molars II.	,,	... ...	74 ,,
,,	Molars III.	,,	... ...	75 ,,
,,	Molars IV.	,,	... ...	75 ,,

The basi-occipital has coalesced with the basi-sphenoid, their sutures being obliterated, as are those of the palato-pterygoids. The maxillo-palatine suture crosses the palate at the interval between the third and fourth molars—touches the aveolar ridge at about the same point, zig-zags along the base of the last molar, turning outwards and downwards to be lost in the overlap of the maxillo-pterygoid plates. If a set of bristles are placed in the nine main foramina of the base of the skull, a similar set in the skulls of the two Wombats, that now exist in South Australia and Tasmania, it will be seen that with leanings now to one, and now to the other, the foramina of the Giant *Nototherium* are all depicted in the two crania named. The anterior condyloid is nearer to the Tasmanian skull; the fissura lacera is partly individual, owing to the enormous development in the *Nototheria* of the par-occipital, and the rest alternate in likeness from one to the other; but the general approximation to the Wombat is exceedingly close all through.

Owing to mutilations in the palate of *Nototherium tasmanicum*, it is not easy to conduct a comparison with the skull now under review, but it appears to have manifested as many differences as the two Wombats' skulls do in their departures from a common type.

The following table of measurements will give an accurate idea of the size of the skull:—

Total length between vertical rods	535 mm.
Greatest width	380 ,,
Height resting upon pre-massiter processes (without mandible) ...	260 ,,
Greatest width of forehead	175 ,,
,, ,, ,, nasals	175 ,,
From occiput—in a central line—to the tips of the nasals	380 ,,
Width of occiput	340 ,,

MANDIBLE.

Having stated that the mandible from the Boyd's Collection (5) is exactly similar to that of our male animal from Smithton, a general knowledge of these jaws will be widely available—since casts are always obtainable from the British Museum, and most Museums hold copies. These jaws are incomplete, anterior to the diastema, and the ascending coronoid processes are missing. Some of these imperfections are now made good by our photograph of the Tasmanian mandible, and these, together with the

(5) Brit. Mus. Cat. Foss. Mamm. f. 32,050.

appended measurements, will supply sufficient data to separate these jaws from those of any other *Nototheria*. From the *Leptocerathine* group, they can be distinguished by the twisted coronoid processes, a character sufficiently well marked to serve all taxonomic needs.

Greatest length between two vertical rods	422	mm.
Height to condyle	280	,,
Length of symphysis	165	,,
Greatest depth of the mandible ...	127	,,
Antero-posterior length of molar No. 4	45	,,
Width of ditto	35	,,
Length of diastema (to base of tusk)	55	,,

Any of the above measurements that can be compared with those furnished by the Boyd's Collection mandible, will demonstrate their specific and sex similarity of the two specimens.

TAXONOMIC.

As we have to deal in the fewest possible words with an extensive mass of notes that directly relate to our subject, we proceed at once to state that Professor Owen's original species, *Nototherium mitchelli*, of which we consider we have determined the sexes, stands apart from all other *Nototheria*. The species were horned, and platyrhine in cranial morphology, and were, moreover, sufficiently removed from the remainder of the stirp to found generic characters upon, if such were a desideratum. We rule out Owen's species, *Inerme*, for the present, but recognise his third species, *Victoriæ*, as being part of the second group that includes the following:—

Nototherium victoriæ, Owen	Date, 1872.
Euowenia grata, De Vis.	Date, 1887.
Euowenia robusta, De Vis.	Date, 1891.
Nototherium tasmanicum, Scott.	Date, 1911.

The several relationships within this group still present difficulties that an accession of future material may banish at any time. Some of these difficulties are directly due to a want of exact knowledge respecting the characters that determine sex, in relationship to growth stages. It looks upon the surface as though *Euowenia grata* was a female animal, and the so-called species, *robusta*, was the male. De Vis admits that *robusta* was so close to Owen's *victoriæ*, that he hesitated upon the

act of separation, but he makes *robusta* a flat tusked animal, which agrees better with a female than a male animal. Now *N. tasmanicum* agrees better with *Euowenia* than anything yet described, and we are convinced that De Vis' crushed skull, elevated to the type of the genus, was mutilated in the nasal regions, and the mutilation masked the real truth as to its normal structure. The skull of *N. tasmanicum* was recovered in thirty-six pieces, and, when first brought to light, was mutilated to the *Euowenia* outline! In other words, the whole nasal platform was carried away, and was not discovered until six weeks afterwards. If the figure of that skull (6) is examined side by side with De Vis' figure (7), it will be easy to see that a few lines with a pencil can convert the one into the other, and before the skull of *N. tasmanicum* was repaired, the likeness was most striking. De Vis' other great generic character was the slender zygomatic arch. This also is a mutilation (8). De Vis did not recognise it as such, because he was comparing the *zygoma* with the *mitchelli* type of animal, and the zygoma of that creature would not easily mutilate in quite the symmetric way that the zygoma of the second group can, and do—accordingly, De Vis mistook the mutilation for a generic character. In all this, of course, De Vis had never seen the unmutilated zygoma of the second group; hence we can understand and appreciate his position, although a mistaken one! For in the second group, the sub-orbital portion of the zygomatic arch is so rounded and thinned away, that a fracture would convert it readily enough into the slender zygoma of De Vis' figure and descriptive text. We have not included in this second group of *Nototheria* the species, *Dunense*, on the grounds that, in our opinion, it really relates to *Phascolonus*. With the clearing up of the *Sceparnodon* and *Phascolonus* puzzle, at the hands of the late Sir E. Stirling, the claims of the type jaws of *Dunense* to any genus other than that of *Phascolonus*, became remote, and in the circumstances we remove it to the *insertæ sedis* section, that includes *Inermis*, *Dunense*, and *Sthenomerus*. Of this latter we have only one word to say, and that is—As the real limb bones of the *Nototheria* were not correctly relegated to the genus *Nototherium* until 1910, and *Phascolonian* bones were previously usurping their places, we consider the bones relegated

(6) Monograph, *Nototherium tasmanicum*, Pl. I.

(7) Proc. Roy. Soc., Queensland, Vol. 4, 1887.

(8) The malar is stripped right out, leaving only the maxillary process in front, and the zygomatic process of the squamosal behind—apparently driven up on to the skull so as to expose its lower edge.

by De Vis to *Sthenomerus* most likely belong to *Nototherium*, and a re-examination of them in the light of later discoveries would, we fancy, establish some such fact. It appears to us that the interests of science will be better served by founding two well-marked groups, than by exhaustively contending the claims of the various species, and in this connection we present the following:—

CLASSIFICATION OF *NOTOTHERIA*.

GROUP ONE.

Megacerathine Group.

GROUP TWO.

Leptocerathine Group.

CONSPECTUS OF *MEGACERATHINE NOTOTHERIA*.

Animals of platyrhine cranial morphology, with flat foreheads and parietal platforms. Nasals not quite covering the nasal aperture; if anything, more so in the female than in the male. Zygomatic arches asymmetrical, the difference being well marked! Sub-orbital bar heavy, and slightly grooved at the malar suture. Tooth-line showing fairly even wear throughout. Teeth with well-marked cingula. Cervicals with strongly developed zygapophyses, and a powerful axian spine. Coronoid process of the mandible twisted from the tooth-line, as in the latifrons Wombat's jaws (9). Skull heavy, short nosed, and horned. A second very small horn may have rested on the frontal cavity. Nasal cartilage attached by bony studs, capable of motion, to resist shock when horning a foe, and also to give extra mobility to the lips. (Example: *Nototherium mitchelli.*)

CONSPECTUS OF *LEPTOCERATHINE NOTOTHERIA*.

Animals of leptorhine cranial morphology, with triangular foreheads and parietal crests. Nasals curved over nasal aperture. Zygomatic arches symmetrical, rounded, and deeply grooved. Tooth-line showing uneven wear, the excess always being anterior. Teeth without cingula, of a heavy type. Cervicals with a slender axian spine. Coronoid process not much, or not at all, twisted from the toothline (10). Skull heavy (less heavy than the other

(9) 35 degrees from the line of symphysis.

(10) 15 degrees from line of symphysis, in *Phascolonus tasmaniensis*.

group), long nosed, and armed only with small nasal bosses, or a very weak horn. Nasal cartilages attached by bony studs, capable of motion, but tending to fuse at maturity, owing to longer nose and weaker horn. (Best known example: *Nototherium tasmanicum*.)

The remaining members of this group are—*Nototherium victoriæ*, Owen; *Euowenia grata*, De Vis; *Euowenia robusta*, De Vis. It is apparent to us that the jaws Professor Owen thought might be those of a female come within this group, but their exact position is uncertain.

It is unfortunate that De Vis' name *Euowenia*, is later in time than *victoriæ*, as it would have made a nice setting to have called this group by that name. The word *victoriæ* is so suggestive of geographical bounds as to cause misconceptions to arise respecting it, and *tasmanicum* came too late in time to enter such a contest, even if it were suitable for such a group—which, of course, it is not! Accordingly, we leave the group to its *Leptocerathinæ* title, only using *Nototherium tasmanicum* as an example, because it is the most perfect skeleton yet recovered. We have a large mass of notes relating to the classification of such Museum specimens as have been fully described, but in our opinions—as already said—the creation of two well-marked groups covers all the immediate needs of taxonomy. In working over the lines ploughed out by those who have gone before us, we recognise nothing but honest attempts to arrive at the truth, and any mistakes that have crept in have been due to imperfect material rather than to any defect of judgment, or want of perspicuity, upon the part of those who rescued and described fragments of jaws and skulls from the pleistocene scrap heaps of Nature. A single illustration will make clear our meaning. De Vis always thought that the oval, tuberculated, premolar of the upper jaw would be opposed by a similar tooth in the mandible, and the narrow elongated tooth that really does oppose it he considered generically distinct! Such are the surprises that Nature springs upon us, that it was only with the finding of associated jaws in 1910 that any accurate data existed upon the subject. Our latest Smithton find—armed with a full set of unworn teeth—displays the wonderful manner in which the elongated, triangular premolar of the lower jaw exactly fits the inner two-thirds of the large, oval, upper premolar—the outer third of that tooth in unworn specimens forming only part of the gripping area. When the mandibular premolars are thus capped, and overhung by the upper premolars, the

anterior tooth-line is firmly locked against lateral motion. This is apparently correlated with the gripping of the tusks upon the lateral incisors, as though the anterior cheek teeth, tusks, and lateral incisors were closed down upon some object to be tightly held (11). In bringing the true molars into action (for cross grinding), the curve of the total tooth-line is such as to free the premolars, and they can cross and recross each other without actual contact, and accordingly, the outer third does not in any sense limit the rolling motion of the jaws under this latter operation. The curve of the tooth-line is aided in this matter by the fact that the mandibular premolars are set lower than the molars. The two factors combined produce the result named.

Here then is the answer to the seeming anomaly of an elongated and narrow lower premolar, being mutually associated with an upper, oval, tuberculated one (one-third greater in width), and which, in occlusion, fits tightly, and duly locks lateral motion when so required.

In the *Leptocerathine* group, the animals all unduly wear the anterior tooth-line, and the premolars, after a time, cut their crowns under the normal action of food grinding; the result is, such premolars are always denuded of their cusping. The cusps in the lower premolars are steeply bevelled, and therefore, the outlines of excessively worn teeth always appear larger than those with unworn crowns. This also clears up a point!

As the condyle of the *Nototherian* jaw is exactly similar to that of the Wombat, the amount of cross grinding action is also similar, but, as just shown, a champing and gripping action is also provided for, it being only necessary to move the contracting pressure of the jaws either forward or backward, to call either into play.

This association of such dissimilar teeth in a single animal possibly throws a sidelight on the old *Protemnodon* and *Procoptodon* puzzle, but we have no specimens to refer to.

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(11) As well as serving for fighting purposes the arrangement of the incisors would be of service to the animal when gathering branches, etc., for its food, the vegetable matter being treated much as a modern wombat does with the longer grasses, etc. We have observed wombats feeding amid such herbage, and their sharp incisors are first brought into play in order to sever the stem from its base, after which the stem is drawn into the mouth for treatment by the molars. Certain of the present day rhinoceroses feed on branches, etc., and most probably such formed a large percentage of the food of the *Nototheria*. The incisive tusks and the general arrangement of the teeth would admirably serve the double purpose of securing food and of being a fighting weapon of no mean order.

It might also be mentioned here that the teeth of certain species of rhinoceroses of the present day serve as an indication of species. In the black rhinoceros, which feeds upon branches, roots, etc., the teeth are worn into alternate ridges and hollows. In the so-called "white" rhinoceros, which feeds by grazing, the teeth are worn into a flat plane.

It will be remembered that in the type skull of *Zygomaturus*, the two premolars are of unequal size, and that De Vis and Lydekker debated this point with some heat (12), the latter always contending that the *Zygomaturus* skull manifested both kinds of premolars, claimed by De Vis as generic characters, and that both could not have been associates of the skull. With what we know of *Nototherian* skull asymmetry, we are not too sure of this, and even supposing that no mutilation of the smaller one was responsible for its reduced size, we could yet believe a normal, and very well marked difference might exist in the two premolars of a single skull.

All of which tends to prove how unwise it is to dogmatise over small dental variations, the more so when a very slight fracture would remove the outer third of a premolar, and so convert an oval and multituberculate one into an elongated angular crown of no special complexity.

THE OTHER SIDE OF THE TAXONOMIC QUESTION.

As we are making every honest endeavour to elucidate the truth, and not attempting to bolster up any special theory, we present the alternative to the double group system of classification here adopted—namely, that of a single species of *Nototherium*, with all variations, the results of age and sex.

We get at the outset the fact that the instinct of Professor Owen led him to determine two good species—*mitchelli* and *victoriæ*, and although Lydekker regarded the latter as a mere individual variation of the former, both Queensland and King Island have yielded similar specimens under conditions that certainly do not suggest any such assumption as that just cited. Nevertheless, if a single species is contended for, this evidence must be set aside, as also the following facts relating to this special connection:—

A. That De Vis found enough variation in the *victoriæ* remains that came to his hand, to found a genus upon, some of which was by admission unsound, but the rest was supported by similar variations observed in Tasmanian *Nototheria*.

(12) Ann. and Mag. Nat. Hist., 1889, p. 150.

B. That the astragalus of *N. victoriæ* (as obtained from King Island) presents enough variation from that of *N. mitchelli* to found a genus upon, and would, if treated as an isolated fragment, be certainly so classified by most palæontologists (*vide* Page 44 of Monograph of *Nototherium tasmanicum*).

Again. It will have to be shown that *Nototherium tasmanicum*, an animal as powerfully tusked as *N. mitchelli*, was a female, in the face of the fact that the original *Zygomaturus* skull presents all the characters that usually determine sex. That this latter is not to be confounded with *N. tasmanicum* is provided for in the circumstances of—

A. A parietal crest as against a sagittal platform.

B. A small forehead, as against a large flat one.

C. A leptorhine, as against a platyrhine cranial habit.

D. Untwisted coronoid processes, as against twisted ones.

E. A tall, slender atlantean spine, as against a wide, heavy, and more or less dwarfed one.

F. It will also have to be explained why the very characters that led us—although quite unbiased as to results—to found *Megacerathine* and *Leptocerathine* groups, are (with the exceptions of those directly relating to the nasal horn) exactly those that segregate the hairy-nosed Wombats from the mainland and Tasmanian forms.

G. That a number of *Nototheria* wore the anterior teeth to the exclusion of the posterior ones is an observed fact—and always appears in the very creatures that apparently fought by gripping with their tusks and lateral incisors, and were by cranial morphology unsuited for the possession of large nasal horns. That these animals were not females, is suggested by their large size and powerful tusks, and by the fact that the type of animal called *victoriæ* had the very kind of tusks one would naturally associate with their mates, and which are not without parallel in the larger animal, we believe to be the female of *Nototherium mitchelli*, thus suggesting, again, their sex determining value.

We do not imagine for one moment that we have cleared up all the mysteries that surround the *Nototheria*, but we hope we have so recapitulated the facts that the discoveries of the future may work more or less smoothly into line, and perfect our knowledge of the wonderful giants of pleistocene days.

When variations of the mandibular symphyses, bounding lines of horizontal rami—namely, contour lines, angles of coronoid processes, positions of dental foramina, etc., have all been relegated to the section headed—"Characters displayed during growth from immaturity to "maturity"—there still remains the material used by us for outlining our two groups of *Megacerathine* and *Leptocerathine* animals, and so for the present we leave the subject with that taxonomic setting.

THE HORN IN THE *LEPTOCERATHINE* GROUP.

Professor Watson's idea of the fighting bosses in *Nototherium tasmanicum* was that of bony eminences covered with skin. If we take an analogy from the Ungulates we get—

1. Rudimentary, skin covered bosses in Horses, as an abnormal condition.
2. Skin and hair covered bosses in Giraffes.

Among the gigantic ungulates of the American tertiary series, many instances of bony bosses obtain.

THE EVOLUTIONARY TREND.

To appreciate even the little we know of the evolutionary trend among the marsupials that culminated in the *Nototherian* stirp, it will be necessary to tabulate the various characters involved therein, with special reference to a geological succession.

PRE-EOCENE.

From Pre-Eocene times, the *Nototheria* retain—

A. Marsupial anatomy generally.

B. Well developed clavicles, relating to pouch manipulation by the hand and forearm.

C. Five fingers and five toes.

D. An entepicondyloid foramen to the humerus.

EOCENE.

From Eocene times, the *Nototheria* retain—

B. Bilophodont molars (still manifested among the modern Tapirs, to some extent) as found in many Eocene ungulates.

B. Flattened femora and humeri of generalised Eocene mammals.

The absence from the head of the femur in the *Nototheria* of a ligamentum teres brings the animals into line with the Eocene *Dinoceras*, as well as the following living and extinct forms:—Elephant, Sea Otter, Sea Elephant, Orang, both forms of *Monotremata*, and the gigantic pleistocene Ground Sloths of South America.

MIOCENE.

From Miocene times, the *Nototheria* retain but little that is essentially characteristic, unless the nasals of such forms as have advanced the least upon the fighting trend really do manifest bony cores, which is at present uncertain. The facts point to a higher stage in *N. tasmanicum*, making an approach to the pliocene dermal horn stage.

PLIOCENE.

From Pliocene times the *Nototheria* retain—

A. The central nasal horn, or horns.

B. *N. tasmanicum*, and its allies, show about the same amount of development in this connection that pliocene ungulates did.

C. *Nototherium mitchelli* appears to have advanced to early pleistocene in this matter, but still retains the pliocene characters of short and wide nasals, as in *Pachygnathus*.

D. A character here also reaches towards the *Tapir* stirp, as much as towards the *Rhinocerotidæ*, namely, in *N. mitchelli*, the nasal septum extends beyond the nasal bones, as in *Elasmognathus*, while in the other *Nototherian* group (*N. tasmanicum* and its allies), the nasals extend to the nasal septum, as in *T. indicus*, *T. americanus*, and *T. roulini*. Always, of course, with special, marsupial variations.

PLEISTOCENE AND RECENT UNGULATE CHARACTERS SHOWN BY *NOTOTHERIA*.

Rhinocerotidæ. The *Nototheria* approach these perissodactyle animals in the structure of the palate, the short neck, the horn, or horns, being developed in the mid-cranial line. The horns are also similarly nourished by anterior central and centro-lateral vascular supplies, but manifested a stirp character, in a central basal blood supply, not found in Rhinoceroses. They also approach these ungulates in the morphology of the occiput.

Taperidæ. The *Nototheria* approach these Ungulates in the matter of bilophodont teeth. In having one premolar deciduous, but show a stirp trend in its being the fourth, instead of the first. They also show the Tapir character of not developing a third trocanter to the femur.

AS AN INDIVIDUAL STIRP.

The *Nototheria* show in the skeleton, marsupial bones, clavicles, an entepicondyloid foramen. Pentadactyl feet and hands. Longer lumbar regions than either Tapirs or Rhinoceroses possess. Premolars reduced to a single pair in either jaw. Incisors retained.

INTER-STIRP CHARACTERS.

Within the stirp the *Nototheria* display a blending of Kangaroo, Wombat, and Native Bear characters, in addition to their own osteology.

RECAPITULATION.

In the *Nototheria* we thus find a group of animals that in Tasmania became extinct late in pleistocene times, that were generalised, and yet, in part, specialised. They retained the racial characters that can be relegated to five geological periods—that is, from the pre-Eocene to the latest pleistocene. They show similar developments to those of the perissodactyle ungulates, and without leaving a single modern representative to carry on their race, in totality, they have left many characters scattered through their marsupial allies—the Kangaroos, Wombats, and Native Bears, who still grace our woodlands to-day.

EXPLANATION OF PLATES XIII.-XXI.

Nototherium mitchelli.

Plate XIII.

The side aspect of the skull giving structural details of the ear, zygomatic arch, tusks, and nasal septum.

Plate XIV.

Showing the face, toothline, nasal studs, pre-alveolar extension of the tusks and the asymmetrical processes.

Plate XV.

Skull resting upon tusks, and pre-massiter processes. Showing nasal platform, nasal studs *in situ*, also concave frontal platform, upon which a second small horn may have rested.

Plate XVI.

Skull, showing the toothline, palate, and basic view generally.

Plate XVII.

Showing nutrient foramina coming up to nasal platform, parietal platform and occiput, also convex contour of the parietals as they contribute walls to the temporal fossæ.

Plate XVIII.

Mandible orientated to show toothline and mutilation to tusk due to an accident in life.

Plate XIX.

Mandible in side view, showing cingula of teeth, dental foramen, etc.

Plate XX.

Mandible arranged to show both condyles, coronoids mutilated (*post mortem*). Contour of condyle similar to that of the platyrhine wombat.

Plate XXI.

Contour lines of the nasal platforms of *Nototherium mitchelli* male and female.

No. 1. Male.—Vertical axis = 110 mm; transverse axis = 108 mm.

No. 2. Female.—Vertical axis = 115 mm; transverse axis = 80 mm.

A & B indicate nutrient foramina in anterior regions. C is a third foramen for nourishing the base of the horn.

STUDIES IN TASMANIAN MAMMALS, LIVING AND EXTINCT.

Number IV.

Nototherium mitchelli.

Appendicular Skeleton, including the manus and pes (hitherto unknown).

By

H. H. Scott (Curator of the Launceston Museum)
and
Clive E. Lord (Curator of The Tasmanian Museum, Hobart).

Plates XXII.-XXIII.

(Read 13th September, 1920.)

INTRODUCTORY NOTE.

The feet of the *Nototheria* have hitherto remained undescribed from associated specimens, although many bones in museum collections have been relegated to the genus. The calcaneum, and astragalus, of *Nototherium tasmanicum* were recovered with the rest of the skeleton in 1910, and the astragalus of *Nototherium victoriæ*, came to light with other associated remains from King Island in 1912. Of the foot of *Nototherium mitchelli*, we have now to record the following bones, all parts of a single pes, and the associates of the skeleton unearthed at Smithton, in 1920, namely:—

(1) Astragalus.
(2) Calcaneum.
(3) Navicular.
(4) Cuboid.
(5) Ento-cuneiform.
(6) Ecto-cuneiform.
(7) Two metatarsals.
(8) One ungual phalanx.

For all practical purposes this outlines the foot, and as the bones, in a general way, conform to the *Diprotodon* type, it will be easy to restore the missing parts, the more

so as the hand is complete in phalangeals, and claw bones, and therefore available for comparison. A glance at the outlines of the hand and foot quickly reveal the disproportion exhibited by the pes, in point of size. This, however, is compensated for in the wide expanse of the sacral regions of the skeleton, sheer weight and pelvic width making up for other reductions.

In the hands, one cannot but be struck by the great palmar expanse, as also the power of the claws. When fully spread such hands would have firmly gripped the soil, and thus presented a most solid and unyielding front to a charging foe. Such manal power must have been a useful factor also during the cranial twist incidental to the horning and tossing of a foe. In this connection it is manifestly obvious that the whole build of the scapular arch is in view of power, and the scapulæ, clavicles, and arm bones, are all called upon to contribute their quota to the total result.

OSTEOLOGY OF THE FOOT.

Plate XXII.

As the astragalus and calcaneum from the left pes of both *Nototherium mitchelli* and *N. tasmanicum* are present, a direct comparison can be instituted, and, with the astragali super-imposed upon their respective calcanei, the following notes were obtained. In spite of the fact that the femur of *N. mitchelli* exceeds that of *N. tasmanicum* in total length by 65 mm., and in width by 47 mm., the bones of the feet present hardly any differences in point of total size, although morphologically they manifest such well-marked differences as one would look for upon their taxonomic segregations. Unfortunately, the post-articular regions of both calcanei are mutilated, and accordingly no measurement of total length can be supplied, that of *N. tasmanicum* is the longer, being 152 mm., while that from the other species is only 127 mm. long. In the former, the whole post-articular muscular attachment area is present, and extends backwards for 50 mm., while in the latter only 25 mm. of this region is present.

The lateral tibial articular tract in *N. mitchelli* is horizontal, but in the other species it slopes forward and downward, is gently concave in the former, and convex in the latter, thus giving a more vertical tibial articulation to *N. mitchelli*, and markedly more angular one to *N. tasmanicum*. In *N. mitchelli*, the calcaneum presents a fibular articular facet 20 mm. long, and 8 mm. deep, the calcaneum projecting some 8 mm. beyond the astragalar

facet. In *N. tasmanicum*, the astragalus overhangs the calcaneum, owing to the greater slope (noted *supra*), thus masking completely the primitive character of a fibular calcaneal articulation, strongly manifested by *N. mitchelli*. To followers of the evolutionary trend, this character will serve to recall the fact that the most primitive member of the sub-order *Perissodactyla*, namely, *Macrauchenia*, exhibited this character, as also did the several members of the sub-order *Taxodontia*. The suppression of such an osteological item should be of taxonomic importance. (1) In conformation with the abovenamed differences between the two astragali under consideration, every other articular surface, and facette, shows similar variations, the details of which it is unnecessary to give, since the articulation of the fibula with the calcaneum, by a well-marked surface, will serve to classify the moiety with the *Megacerathine Nototheria*, and the absence of such will relegate it to the *Leptocerathine* group.

The total height of the superimposed bones in *N. tasmanicum* is 120 mm., and that of *N. mitchelli* 122 mm., their astragalar widths (in articular position) being 82 mm. and 74 mm. respectively. For the classification of fragments of calcanei the best guide in the absence of the evidence yielded by the fibular facet, is that of the whole articular surface. In *N. mitchelli*, the sizes are 80 mm. in antero-posterior length, with a width of 70 mm., while in *N. tasmanicum*, the surface is 60 mm. x 60 mm. The antero-posterior slope in *N. mitchelli* is only 30 degrees, while in *N. tasmanicum* it is 50 degrees. When perfect, the two sets of bones must have been fairly similar in point of size and robustness. It is most unfortunate that the bones of the tarsus and toes are unknown in *N. tasmanicum*, as the digital reduction may have—indeed, we feel convinced must have—shown interesting grades when compared with those of *N. mitchelli*.

As far as we can judge (working only from photographs of the foot of *Diprotodon*), the articular cup for the astragalus is formed in the *Nototherium*, in about the same proportions as that which obtains in *Diprotodon*, namely—

(1) The largest share by the navicular.

(2) The next in importance being that contributed by the calcaneum.

(3) The minimum share being supplied by the cuboid.

(1.) In the kangaroo, the primitive character is retained, *in toto*, the fibula being elongated to reach the articular facet of the calcaneum—to the amount that the astragalus rises above that bone, in this region. Its almost suppression in *N. mitchelli*, and its total suppression in *N. tasmanicum*, are the facts to be kept in sight.

With Dr. Stirling's photo of the *Diprotodon's* pes (2) placed side by side with the foot of *N. mitchelli*, we note that in the latter—

1. The external horn of the navicular is much more expanded at the base.
2. The ecto-cuneiform is more elongated.
3. The ento-cuneiform is relatively more robust.

As far as it is fair to express an opinion, we would state that our material suggests less reduction of the toes than obtains in the *Diprotodon*. Allowing for missing bones, and, therefore, in part open to future emendation, the following set of measurements are submitted:—

Total length of foot	=	355 mm.
Greatest width	=	171 mm.
Width of toes	=	105 mm.

The *Nototherian* astragalus does not closely simulate that of the Wombat, but, if that bone from the foot of the Tasmanian Wombat is compared with the two astragali of the *Nototheria* just passed in review, it will be found to agree better with that of *N. tasmanicum* than the corresponding moiety from the pes of *N. mitchelli*. We have no bone to contrast, and compare with, from the platyrhine wombat, but we strongly suspect the astragalus from that animal would agree best with *N. mitchelli*, and so follow out the sequence so frequently noted during our studies.

THE MANUS.

Plate XXIII.

As with the pes, so with the manus, the parts present belong to the left side, and are not quite intact as to several moicties. We hold the following, however:—

(1) Pisiform.
(2) Cuneiform.
(3) Unciform.
(4) Scaphoid.
(5) Magnum.
(6) All five metacarpals.
(7) Four phalanges of the proximal series.
(8) All five ungual phalanges.

From the carpus there are missing the following bones, namely:—

(1) Trapezoid.
(2) Trapezium.
(3) Scaphoidal sessamoid.

Also six phalanges.

(2.) Foss. Lake Callabonna, vol. I., part 1, plate 10.

As the pisiform, and cuneiform, outline the ulnar cup, and the scaphoid can be articulated to the end of the radius, the loss of the items named will not seriously affect the articulation of the hand, the presence of the complete set of metacarpals is most fortunate, as is also the set of ungual phalangeals. Finger five is intact, and so a measurement taken from the end of the pisiform to the tip of the claw-bone supplies a size-determining factor. Taken thus, the hand measures 270 mm. in length, but this is less than actual totality by anything up to 25 mm., since the fifth is not the longest digit. In life, with claw sheaths *in situ*, this hand must have been quite 300 mm. long, by 145 to 150 mm. wide. In Tapirs, the hand always contains more digits than the foot, but in no known instance do they ever reach as high as five. In the Rhinoceroses, at least three digits enter into the composition of the pes, while the manus may retain four. The marsupials largely show a digital reduction of the pes, but, owing to the necessities for manipulating the pouch, the hand has remained intact. In the *Nototheria* the feet were obviously following the trend, but the stirp became extinct before the climax had been reached. In view of this latter fact, nothing very remarkable appears in the manal osteology; the pisiform and cuneiform supply the ulnar cup, the unciform gives articular facets to digits four and five, the magnum supports digit three, the trapezoid and trapezium carry the remaining digits. The scaphoid being mainly supported by the magnum, brings the *Nototheria* into line with the Tapirs and Perissodactyla generally.

As the ungual phalanges form a complete set, and have hitherto been undescribed, we supply a table of dimensions.

CLAW-BEARING PHALANGES OF *NOTOTHERIUM MITCHELLI*.

(Left Hand.)

Name.	Total Length mm.	Width (Basal) mm.	Girth mm.	Remarks.
Digit No. 1 ...	55	31	87	Condition perfect
Digit No. 2 ...	56	25	77	Condition perfect
Digit No. 3 ...	62	26	80	Condition perfect
Digit No. 4 ...	71	27	84	Condition perfect
Digit No. 5 ...	71	23	83	Condition perfect

THE RADIUS AND ULNA.

As neither radius nor ulna was complete in *N. tasmanicum*, no measurements could be supplied when the monograph upon that animal was compiled. With *N. mitchelli*, we get both bones from the right side, and a perfect ulna from the left, the associated radius, however, being distally imperfect. The left ulna is 437 mm. long, the right being 436 mm. The right radius is 385 mm. long. As both bones have been figured proximally (*vide* plate 10, monograph *N. tas.*), it will be only necessary to say that distally the ulna ends in a perfectly round head, 36 mm. in diameter, while the radius expands to a transverse width of 80 mm., its proximal cup being only 50 mm. x 48 mm., which is exactly the same in *N. tasmanicum*.

THE STERNUM.

Four moieties of the sternum of *N. mitchelli* were recovered with the other parts of the skeleton. These consist of the manubrium, and three sternebræ of the Gladiolus. Possibly two segments, and the ziphoid element are missing. In articulating the skeleton of *N. tasmanicum*, ten pairs of ribs were carried to the sternum, seven of which were attached to the pre and meso-sternum. This must be very close, if not actually, the condition that really obtained in these animals, and, accordingly, two sternebræ are missing from the mesosternum of *N. mitchelli*, in addition to the metasternal element. The manubrium is 100 mm. long, and 108 mm. wide; it is heavily keeled, the carina ending in a tuberosity that projects outwards for 45 mm. If this tuberosity is pressed against the vertical plate of the measuring board the total thickness of the bone is 71 mm.

The sternebræ are furnished with nearly square bodies, and expanded ends; the two perfect ones measure 75 mm. and 74 mm. respectively, in total length, with a width of 40 mm. at the ends, sinking to a central width of 28 mm. in vertical measurement, the transverse rim measurement being 26 mm. Vertically, the surfaces are convex and concave—transversely concave—on either side.

FEMUR.

The femur closely simulates that of the *Leptocerathine* group (as duly figured in plate No. eleven of the monograph of *N. tas.*), but is larger, as the appended table will show. Being a younger animal, the muscular surfaces are less strongly marked; indeed, the femur, as a whole, is a smooth one, as indicates the age stated.

FEMORA OF *MEGACERATHINE NOTOTHERIA*, AND THOSE OF THE *LEPTOCERATHINE* GROUP.

(No. 1 = *N. mitchelli.* No. 2 = *N. tasmanicum.*)

No. 1.	mm.	No. 2.	mm.
Total length	= 540	Total length	= 475
Across condyles ...	= 157	Across condyles ...	= 153
Girth below head	= 275	Girth below head	= 251
Diameter of head	= 89	Diameter of head	= 83
Girth above condyles	= 385	Girth above condyles	= 381
Girth, including condyles	= 474	Girth, including condyles	= 451
Width between two vertical walls	= 251	Width between two vertical walls ...	= 204

HUMERUS.

The left humerus is here selected from the skeleton of *N. mitchelli*, so as to fall into line with that of the monograph of *N. tasmanicum*.

COMPARATIVE HUMERI.

(No. 1 = *N. mitchelli.* No. 2 = *N. tasmanicum.*)

No. 1.	mm.	No. 2.	mm.
Total length	= 496	Total length	= 467
Ecto-tuberosity to end of pectoral ridge	= 268	Ecto-tuberosity to end of pectoral ridge	= 238
Proximal width ...	= 120	Proximal width ...	= 125
Distal width	= 175	Distal width	= 175
Least width of shaft	= 71	Least width of shaft	= 62
Thickness of radial condyle	= 57	Thickness of radial condyle	= 58
Thickness of ulnar condyle	= 60	Thickness of ulnar condyle	= 60
Width of condylar articular surface	= 132	Width of condylar articular surface	= 124

A curious relationship between the width of the distal end of the humerus, and the length of the mandibular tooth line, has been noted by De Vis in the case of Wombats, and suspected by him to extend to the *Nototheria*. If the mandibular tooth line of *N. mitchelli* is measured it will be found to be 171 mm., while the distal end of the humerus is 175 mm., as noted *supra*.

TIBIA.

The tibia of *N. mitchelli* is generically similar to that of the second group, but shows various departures from that type. The shaft upon the whole (allowing for age characters) is similar, but the articular surfaces show the variations we might expect to find in animals whose gait was dissimilar.

COMPARATIVE SIZES OF TIBIÆ, IN THE TWO GROUPS.

(No. 1 = *N. mitchelli*. No. 2 = *N. tasmanicum*.)

No. 1.	mm.	No. 2.	mm.
Total length between two vertical walls	= 327	Total length between two vertical walls	= 284
Greatest proximal width	= 134	Greatest proximal width	= 125
Greatest distal width	= 92	Greatest distal width	= 88
Least distal width	= 66	Least distal width	= 63

THE FIBULA.

If anything, the fibula of *N. mitchelli* is more bent in the shaft than that of the second group, and the articular surfaces manifest their own special characters. These need not be noted *in extenso*, as the size of the bone will serve to separate it from one of the other race.

COMPARATIVE FIBULÆ.

(No. 1 = *N. mitchelli*. No. 2 = *N. tasmanicum*.)

No. 1.	mm.	No. 2.	mm.
Total length between two vertical plates	= 282	Total length between two vertical plates	= 248
Greatest proximal width	= 84	Greatest proximal width	= 73
Least proximal width	= 67	Least proximal width	= 64
Greatest distal width	= 59	Greatest distal width	= 52
Least distal width	= 49	Least distal width	= 43

THE CLAVICLES.

The clavicles of *N. mitchelli* agree in outline exactly with those attributed to *Diprotodon*, and depart in contour from those of the *Leptocerathine Nototherian* group, in exactly the way noted in the monograph upon *Nototherium tasmanicum*. Owing to this variation in shape, it is not easy to give comparative contour measurements, but the following may prove useful.

COMPARATIVE CLAVICLES.

(No. 1 = *N. mitchelli*. No. 2 = *N. tasmanicum*.)

No. 1.	mm.	No. 2.	mm.
Greatest length ... =	171	Greatest length ... =	150
Height of arch ... =	94	Height of arch ... =	87
Greatest width ... =	47	Greatest width ... =	37
Least width ... ... =	24	Least width ... ... =	29

In every way the clavicles of both *Diprotodon* and *Nototherium mitchelli* are more shapely bones than those from the *Leptocerathine Nototheria*. They are wider at the acromial end of the shaft, and more slender as the shafts approach the sternal facets. Apparently this extra thinning of the shaft did not introduce an element of weakness at this point, since the broken clavicle of *N. mitchelli* snapped well above the thinnest part of the shaft. In attempting to repair this fracture, the periosteal membrane poured out enough ossific matter to increase the width of the bone by 20 mm.; at the same time it contracted its length (by altering the curve of the outline) some 13 mm.

THE SCAPULÆ.

Both scapulæ are imperfect as to length, and otherwise mutilated. This is owing to the complete exposure of the right side of the animal to wind and weather for many years—the left side being buried in the mud saved the lower part of the left scapula, the apex, however, being above the water line came in for unfair treatment. The longer of the two measures 395 mm., the complete length being most likely 450 mm. That of *N. tasmanicum* is 430 mm. in an intact specimen, so we may assume the larger animal's shoulder blade was some 20 mm. longer. The width of the nearly perfect left scapula is 253 mm. Except in the matter of age, the scapulæ agree fairly well with those figured, and described in the monograph upon *Nototherium tasmanicum* (*vide* page 23, and plate 9.) The age factor, of course, omits the superossification due to matured muscular attachment. The great fossa

marked by an arrow in the picture is less strongly indicated in the younger animal—presumably, this fossa related to the infra spinalus, and teres muscles, and a second groove may relate to the scapular dorsal artery. The acromion process is 110 mm. wide, and is roughened for the enormous deltoid muscle, that ascended the spine for 245 mm., in addition to involving the whole of the distal end of the actual process.

THE PELVIS.

The pelvis of *Nototherium tasmanicum* has been duly illustrated and described (plate 15, pages 34 and 35 monograph), and this will serve the purpose of a generic description, but the comparative study we had hoped for was marred by the fragmentary character of the pelvis of *Nototherium mitchelli.* As far as the specimens serve we are safe in saying that the *Megacerathine* animal was similar to that of the *Leptocerathnie* one in the pelvic regions, and if a complete set of measurements could be supplied the former would be presumably somewhat larger than the latter. To avoid the necessity of reference, we reproduce here the scale of sizes already published.

PELVIS OF *N. TASMANICUM*.

		mm.
(1)—Total width across the slightly imperfect ilia	=	702
(2)—Greatest width of least mutilated ilium	=	235
(3)—From tuberosity of ischium to upper rim of ilium	=	535
(4)—Width of pelvis across rims of the acetabula	=	422
(5)—Transverse measurement of inlet of pelvis ...	=	172

In the pelvis of *N. mitchelli* the whole of the sacral portion is torn away, and neither of the ilia is perfect. An attempt to compare measurement No. 3 of the above table gives 500 mm. for a slightly smaller portion than is present in the pelvis of *N. tasmanicum*, thus suggesting a rather larger pelvis as a whole. For articulation purposes the pelvis of *N. mitchelli* has been now restored, and as so outlined its greatest width across the ilia is (36in.) 915 mm. This may eventually prove to be too wide, but at least 100 mm. in excess of that of *N. tasmanicum* is certainly within the mark.

COMPARATIVE SKULLS OF *NOTOTHERIA*.

At an earlier stage of this work we promised to give a table of contrasting skull characters, and although in part this has been supplied in drawing up the conspectus

of either group, yet to a practical worker it will be exceedingly convenient to have a ready reference table such as that hereunder supplied.

	Megacerathine Nototheria.		*Leptocerathine Nototheria.*	
Characters	Male.	Female.	Male.	Female.
Nasal bones	Wide and heavy, 175 mm. wide.	Not quite so heavy, 160 mm. wide.	Smaller than the female of *N. mitchelli*, total width 138 mm.	Although at present the data is too slight to give with any degree of accuracy, the future will be certain to supply this information.
Forehead and parietal regions.	Flat & wide with a parietal platform.	Similar to male, but smaller.	Small forehead, and a long parietal crest.	
Zygomatic arches.	Heavy processes not symmetrical.	As in the male.	Lighter in build, more grooved, and symmetrical.	
Nature of tusks.	Oval in outline, widely divergent, powerful.	Flatter in outline, less divergent, less powerful.	Oval in outline, widely divergent, and powerful, quite as powerful as males of the other group.	
Cranial walls	Convex to the temporal fossæ, strongly so.	As with the male.	Concave to the temporal fossæ, as strongly so as they are convex in the other group.	
Pre-massiter processes.	Bent back to molar No. 3, and blades twisted outwards.	Bent back to molar No. 3, blades twisted slightly outwards.	Bent back to molar No. 4, blades twisted inwards.	
Squamosal element of the zygomatic arch (contour line).	Leaves occiput concave, thus for a very small space, thence convex to the suture.	Leaves occiput concave, thus for a space, thence convex, and lastly nearly straight to the suture.	Leaves occiput with a big convex swelling, slopes concavo-convexo-concave, to suture.	

For other details see the text of the articles already published.

I

THE EXTERNAL EAR, AN OSTEOLOGICAL COMPARISON.

It is an interesting piece of parallel evolution to observe how closely the *Nototherian* ear simulates the conditions obtaining among true Rhinoceroses, and then to pass in review the skull elements out of which they have been developed. Although we have carried out this study widely enough to embrace various Rhinoceroses, space forbids the publication of more than a small portion of our data.

In the Tichorhine Rhinoceros, the meatus auditorius is formed by the post-glenoid—which is a powerful process—reaching backwards to meet a similar contribution from the mastoid, the line of junction being vertical and central. In a general way the Indian Rhinoceros repeats this set of conditions, although the true ear bones may be loose. If the photograph reproduced in plate xiii. is appealed to, it will be seen that in *Nototherium mitchelli* the loose tympanic tube of the Wombats' is here strongly inset, between the backward curve of the post-glenoid and the forward sweep of the mastoid, the whole having coalesced into a single element.

Group departures from these conditions are found in the *Leptocerathine Nototheria*, not sufficiently important to detail here. (3) Now let us see how these structural moieties exist in the Wombats, and the Native Bear.

Tasmanian Wombat.

There is a post-glenoid process, which is removed mesiad from the contour line of the skull, and is shorter than the mastoid process. The tympanic is tube-like, and distinct, and the par-occipital is short.

Hairy-Nosed Wombat.

The post-glenoid is obsolete; the mastoid is thin and long; the tympanic is suspended mid-way between the glenoid articular wall, and the mastoid amid deeply excavated air cells.

Native Bear.

Strong post-glenoid process (deeply excavated by air cells), tympanic deeply set in a fossa between the post-glenoid and the squamoso-mastoid process, long par-occipital process.

(3.) Briefly it may be said that the ear is a stage nearer the primitive condition.

We may assume in this connection that the Wombats are nearer to the primitive marsupial than the Native Bear is, and that in the *Nototherium* the post-glenoid and mastoid enclosed the tube-like tympanic—that still remains distinct in the Wombat, but has developed a special stirpian trend in the Native Bear.

Here, then, we get a result structurally the same, in three animals widely removed as to habitat, one having ranged Europe in pleistocene time, a second living in Australia in the same age, and a third still living in the Indian zoological province. The Marsupial Rhinoceros (*Nototherium*) still shows exactly how the ear was evolved out of the elements common to more than one type of marsupial that still survives.

THE SIZE OF *NOTOTHERIUM MITCHELLI.*

It is an interesting study to try to recall the alteration in size of the animal here under consideration, that these new discoveries have forced upon our mental vision. Professor Owen allowed for a large animal, and as the female skull known to him—and so carefully studied in detail—falls little short of the male cranium in point of size, he was in this respect fairly well informed. In forehead, and nasal expansion, the male, however, exceeds the female by a full inch, and therefore his remark that in its facial parts *Nototherium* was the quaintest animal that ever lived receives additional support, since an extra inch in the dilation of an animal's nose completely changes the facial contour. The arms and legs, he assumed, were bulky, but relatively shorter than we know them to be, as note the size of the upper arm. The humerus Owen allowed for was 400 mm. long and 224 mm. wide. The real humerus is 496 mm. long and 175 mm. wide. Thus the upper arm bone was narrower by two inches, and longer by nearly four inches than was suspected of. If this ratio is carried out to all the bones of the appendicular skeleton, we are apparently dealing with an animal at least a foot taller than Professor Owen computed it to be. Even the *Leptocerathine* group of *Nototheria* were longer in their humeri by 67 mm. ($2\frac{5}{8}$ inches) than the humeri relegated to the *Nototheria* generally, and the elongation of their scapulæ to a measurement of 430 mm. (just on 17 inches) would certainly never have been guessed at.

The long narrow foot, not known to have been associated with the animal, and the excessively wide and heavily clawed hand are also new items, all of which, taken in totality, considerably alter the animal's make-up

as originally visualised. Upon the other hand, the great palæontologist had his share of success, correctly associating the skull and jaws (that by reason of their apparent anomalies acted as stumbling blocks to others for more than half a century). Again, in the matter of the imperfect mandible, from South Australia, he instinctively and with unerring accuracy separated it from the type species; and seeing as in a glass darkly the real significance of the evolutionary trend he listed the nasal septum of both *Diprotodon* and *Nototherium*, in the same category with such structures in the Tichorhine Rhinoceros. As some students of Professor Owen's works upon "Extinct Mammals of Australia" appear to have missed the association of *Nototherium* with *Diprotodon*—and therefore with the Tichorhine Rhinoceros—in this matter of the nasal septum, it may be opportune to recall his actual data relating to this subject. At page 524 (part 3, Foss. Mam. Aust.) he notes the development of the nasal septum of *Diprotodon*—out of the ordinary marsupial anatomy—to the condition that obtained in the Tichorhine Rhinoceros, and again at page 51 of part 5, he links *Nototherium* with *Diprotodon* in this respect, remarking, *inter alia*, that among the marsupials these two animals stand alone. *Ipso facto*, therefore, both approached the extinct Perissodactylan Ungulate, to a greater or lesser degree. We now know that in the *Leptocerathine* group, the nasal bones and nasal septum approached each other very closely—while in the other group, the nasals receded for some 40 mm. in the male animal, but less in the female.

RECAPITULATIVE NOTES.

If the aim of our studies has been realised, we shall have to some extent convinced zoologists, and palæontologists, of the fact that the Rhinoceros was not absent from the fauna of Australia in ages past. True to the structural type of the country, these animals retained the marsupial habit, simply grafting on to it the results of that evolutionary trend that has culminated in other lands in the Perissodactylan Ungulates. Just how many groups Australia could boast of we are at present unable to say, but apparently two, at least, were well segregated at the time extinction overtook the race. One of these, the *Megacerathine* group, manifested more development along the fighting trend than the second, or *Leptocerathine* group did. This is noticeable chiefly in the alterations to the nasal bones for the attachment of the horn; the extra strengthening of the neck; the general enlargement of the whole skeleton to maintain a suitable poise; the

dilation of the skull walls to provide extra air cells, to deaden shock and to combine lightness with strength. Starting (in the limbs) with pentadactyle hands and feet, and the primitive character of a fibula articulating directly with the calcaneum, they changed to a condition that was rapidly reducing the number of toes (as in the Rhinoceroses) and the fibula was slowly losing its articular grip of the calcaneum. In the *Leptocerathine* group it had absolutely done so, and in the *Megacerathine* group the articular facet was extremely reduced. The ear was being evolved to suit the new conditions of life, and in total result had reached a rhinoceros state of development, but the primitive material available to a marsupial animal being different from that which obtained in the Eocene Ungulates, the method of elaboration was quite distinctive, as duly noted above. As no *Diprotodons* have as yet been found in Tasmania we have not, by written word, attempted to speculate upon their relationship to the two groups we have had under review. Our personal views are therefore unexpressed, for the present. Students of Palæontology need not travel to the wastes of America to find remains of animals that closely simulated the Perissodactyle Ungulates, since they have in Australia, and Tasmania, the evidence of creatures that started with a primitive marsupial habit, and while unfolding that exceedingly interesting zoological form, some of them embraced, *pari passu*, the evolutionary trend that produced the Rhinoceros and Tapir stirps in other parts of the world. America is said to have elaborated seven groups of, more or less, Rhinoceros-like animals; it remains for the future to say what number actually existed in the Australian zoo-geographical province. Professor Owen first glimpsed the effect of the embracing evolutionary trend, in the year 1870. Professor Watson directly extended the idea when viewing the Tasmanian *Nototherian* remains in 1914. Early the next year, Mr. L. Glauert, of the Perth Museum, in Western Australia, expressed a tentative opinion upon the subject, after four months' work upon the fossil bones of the Mammoth Cave, but felt unable to state exactly how far the rhinoceros trend had advanced, his exact opinion (as reported at the time) being that the "*Nototherium* was a gigantic Tapir, or "Rhinoceros-like animal." In 1915, also, H. H. Scott reviewed the evidence yielded by a study of a *Leptocerathine* *Nototherium* (*N. tasmanicum*) in the light of its being purely a Tapir-like animal, but abandoned the view in March, 1917, in favour of that advanced by Professor Watson (*vide* Brochure No. 6, Launceston Museum Series).

The reasons for opposing the Rhinoceros habit, in *N. tasmanicum*, as also the evidence in favour of the same, in the light of information supplied by the study of the skeleton of *Nototherium mitchelli*, have been duly set out, in our Paper No. 3, and therefore need not be recalled here. As far as we know, we have fairly impartially weighed every fact of importance recorded by any and all workers, in this particular branch of Palæontology, and the final result has been the several views expressed in our short series of papers, of which the present constitutes No. 4.

For the scientific use of the skeleton of *Nototherium mitchelli*, we are indebted to Mr. K. M. Harrisson, of Smithton, who generously placed the specimens at our disposal for the purpose named. Mr. Harrisson has also presented the whole of the remains to the Tasmanian Museum, Hobart, with a view to their future exhibition at that institution. In conclusion, we may just add that the order in which the osteological evidence has been reviewed was largely determined by the condition of the material—some bones being unfit to handle for months, while others were stable at an earlier date.

ADDENDUM.

After our notes upon the nasal ossicles, found in the skulls of the *Nototheria*, were in print we discovered that similar structures had been recorded, by Prof. O. C. Marsh, as appearing in the gigantic *Dinocerata*, of Eocene, North America. Prof. Marsh published his note in 1884 (U.S. Geological Survey, monograph No. 10, page 14), and regarded the structures as being quite unique, but suggested that they had survived in a modified state in the modern artiodactyla as the pre-nasals of the genus *Sus*. Obviously, if this homology is correct, the ossicles must have been developed as a common ungulate possession prior to the divergence of the perissodactyla from the artiodactyla, as it is unlikely they were separately evolved. The parellel development of such structures in the *Nototheria* is an exceedingly interesting point, as also is the appearance of a single central ossicle in the South American Mylodon—as duly noted in our text.

The teeth of *Tinoceras stenops*, figured by Marsh at page 47 of his monograph, show a disproportion between the upper and lower premolars, that is almost similar to that obtaining in the *Nototheria*. The cusping, of course, is quite different.

EXPLANATION OF PLATES XXII.-XXIII.

The Pes and Manus of *Nototherium mitchelli.*

Plate XXII.—Left foot of *N. mitchelli*. Astragalus in position. All missing bones outlined in black. The facet for the articulation of the fibula, with the calaneum, being well shown.

Plate XXIII.—Left manus of *N. mitchelli.* This plate shows the great spread of the hand, the powerful claws, and the general conformation to the marsupial type. Some bones missing—outlines supplied in black.

THE EARLY HISTORY OF BRUNY ISLAND.

By

Clive E. Lord

(Curator of the Tasmanian Museum).

(Read 13th September, 1920.)

Many of the coastal features of our Island State are entwined with the romance of its early history. The nomenclature recalls visits of the hardy navigators, who, in years gone by, sailed amid the uncharted areas of the Southern Ocean in search of the Great South Land. Later, as the discovery of Australia became known, various expeditions added, little by little, to the knowledge of the coast line. The Southern part of Tasmania came in for a considerable amount of attention in the early days, mainly owing to the fact that the existence of Bass Straits was not known, and all vessels coming from the westward had to weather the South-West Cape in order to reach the East Coast of the Continent and the seas beyond. Some stayed for the purpose of examining the coast more closely whilst others merely sought the land in order to replenish their supplies of wood and water. Nearly all the navigators of whom we have record, however, left some trace of their visit by naming the prominent features of the locality wherein they stayed. In a previous paper (1) I traced the early history of Maria Island, and in the present instance it is desired to place on record a few facts that have been compiled in relation to Bruny Island and its early explorers. In doing so it must be remembered that the records will be merely those of whom we have knowledge. While they were undoubtedly the chief ones, it is well to recall that there were probably many ships that set forth to explore the Southern seas, but which never returned.

Whence, or how, Tasmania became to be inhabited by the dusky aborigines, who withered away so rapidly with the advent of the European settlement, we have no certain knowledge, although many theories have been advanced. They were here long before the seventeenth century, and doubtless gazed with wonder at the high pooped Dutch vessels which appeared off the South Coast in the spring of 1642. For it was on the 29th of Novem-

(1) The Early History of Maria Island. P. and P. Roy. Soc. Tas., 1919.

ber that Tasman's ships the *Heemskerck* and *Zeehan*, working round from the West Coast, passed several rocky islets, one of which Tasman compared to the shape of a lion. (2) Another was named Pedra Branca, owing to its likeness to a similar rock of that name off the coast of China, while a third was referred to as being like a high rugged tower. (3)

With the aid of a westerly breeze the Dutch ships continued their course along the shore, the islands at the south-east corner of Bruny Island were noticed, and to these the name Boreel Islands was given. (4) Towards evening the ships were making for a bay (5) intending to come to anchor when a north-westerly gale arose and blew the vessels to sea again, (6) and when they were able to again close with the land, several days later, they anchored on the East Coast. (7)

Had Tasman been able to come to anchor in Adventure Bay his stay in Tasmania might have been of a longer duration, and the discovery that Bruny was an island made then instead of a century and a half later. The Dutch explorations were made, however, with the chief object of extending the trade of the Dutch East India Company, and not for the mere spirit of adventure. The rugged coasts of this hitherto unknown South land, which Tasman named Van Diemen's Land, after the Governor of Batavia, did not offer any promise of filling the coffers of the company, and we hear of no further Dutch expeditions to this locality.

More than a hundred years later the Frenchman, Marion du Fresne, in command of the *Mascarin* and the *Marquis de Castries* sighted Tasmania. (8) Following on Tasman's charts he coasted along the shore and anchored on the East Coast, (9) a few miles to the north of where the Dutch navigator had furled his sails. Marion's charts merely represent the impressions of the coast obtained by the second European explorer to visit Tasmania, coasting along several miles off shore. As far as Bruny's

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(2) Identified by Furneaux in 1773, and named the Mewstone

(3) Cook, in 1777, named this the Eddystone, owing to its resemblance to the English lighthouse of that name.

(4) Furneaux mistook Tasman's localities and renamed the Boreel Islands the Friars. The latter designation is now the one generally used. (See note on nomenclature of Tasman's Head, page 135.)

(5) Evidently the south end of Adventure Bay, where Furneaux anchored in 1773.

(6) Hence the name Storm Bay for the large bay at the estuary of the Derwent.

(7) Tasman, Abel Janszoon—Journal of a Voyage in 1642. Amsterdam, 1898.

(8) Marion sighted V.D.L. on the 3rd of March, 1772.

(9) At Marion Bay.

history is concerned, Marion's visit scarcely needs to be considered. (10)

Captain Cook's second voyage to the South Seas commenced in April, 1772, his ships being the *Resolution* and the *Adventure*, Captain Tobias Furneaux being in command of the latter vessel. After leaving the Cape of Good Hope the vessels became separated during a thick fog on the 7th of February, 1773. Cook sailed direct to New Zealand, but Furneaux touched at Tasmania, or as it was then known, the South Coast of New Holland, before rejoining his chief. Furneaux sighted the land near the South West Cape on the 9th of March, 1773, and hauling in for the coast he passed and named the Mewstone Rock, off the entrance to the Channel. On the morning of the 10th, a boat was sent ashore, and on its return the crew reported that they had seen "several places where the Indians had been." The captain of the *Adventure* remarked upon the boldness of the shore, and referred to the fact that it seemed to afford several large bays or anchoring places. It remained for D'Entrecasteaux, however (as the result of an accident), to show that one of these bays was, in reality, a magnificent channel. Furneaux evidently noticed the entrance and took this, together with Cloudy Bay (off the South Coast of Bruny), to be the Storm Bay of Tasman. He records passing "several small islands "and black rocks" which he named "the Fryars." These were actually the Boreel Islands of Tasman, but Furneaux imagined himself to the East of Tasman's Islands—a fact which has led to much confusion. (See remarks on nomenclature of Tasman's Head, page 135.)

At seven in the evening of the 10th of March, being abreast of a fine bay, and having little wind, the vessel came to anchor in twenty-four fathoms, sandy bottom. Furneaux remarks—"We first took this bay to be that "which Tasman called Frederick Henry; but afterwards "found that his is laid down five leagues to the north- "ward of this." As a matter of fact Tasman's anchorage was about fifty miles to the North-East.

The whole of the next day was spent in selecting a watering place and moving the ship further into the bay. Furneaux mistook the present Tasman Peninsula for the Maria Island of Tasman, and records bearings to it. During the five days that the vessel was in the bay several expeditions were made on shore, and the explorers noticed that the trees were mostly burnt near the ground, this being done by the natives, who were in the habit of set-

(10) Crozet's Voyage to Tasmania, New Zealand, etc., 1771-72. Trans. by Ling Roth. London, 1891.

ting the undergrowth on fire. Of the birds observed the following are mentioned in the chief account (11) of the voyage—"A bird like a raven, (12) some of the crow kind, "black, with tips of the feathers of the tail and wings "white, their bill long and very sharp; (13) some paroquets. "The sea-fowl are ducks, teal and the sheldrake. A large "white bird which one of the gentlemen shot, about the "size of a kite of the eagle kind." (14) Of the animals the only record was an opossum. (15) In Forster's account (16) of the voyage, mention is made of a fresh water lake, covered with great flocks of wild ducks and other aquatic fowls.

Furneaux refers to the fact that traces of the natives were noticed and records finding in one of the rough shelters several of their crude implements. These were collected, and in their place were left "several medals, "gun flints, a few nails, and an old empty barrel." After having completed the task of taking in a supply of wood and water, Furneaux sailed from the bay (which had been named *Adventure* after his ship) on the 16th of March.

During Captain Cook's third voyage, the illustrious navigator personally examined portion of the Tasmanian Coast. His ships, the *Resolution* and *Discovery*, (17) arrived off the coast on the twenty-fourth of January, 1777, and in the evening were near the Eddystone Rock, which Cook named. The discovery of the Channel was forecasted, as in describing the coastline Cook states—"I am of opinion "that, were this coast examined, there would be found "some good harbours."

Owing to the wind coming from the South East, it was decided to put into Adventure Bay, and the ships were accordingly brought to anchor. Parties were sent ashore to gather wood and grass, and one such party was surprised by the appearance of several aborigines. Cook's description of the natives states that they were of common stature, but rather slender. "Their "skin was dark, and also their hair, which was as woolly "as that of any native of Guinea; but they were not dis-"tinguished by remarkably thick lips nor flat noses. On "the contrary, their features were far from being disagree-"able. They had pretty good eyes, and their teeth were "tolerably even, but very dirty. Most of them had their

(11) Cook's Voyages.

(12) *Corvus coronoides.*

(13) Probably *Strepera arguta.*

(14) Probably *Haliaetus leucogaster.*

(15) *Pseudochirus cooki.*

(16) Forster—A Voyage round the World. Dublin, 1777.

(17) The *Discovery* was a vessel of 300 tons, and was commanded by Captain Clerk.

"hair and beards smeared with a red ointment, and some "had their faces painted with the same composition."

The morning of the twenty-ninth of January fell flat calm and prevented Cook from sailing as he had intended. Several parties, therefore, went ashore, and about twenty natives soon appeared. One of the aborigines is described as being "not more distinguishable by the hump upon "his back, than by the drollery of his gestures and the "seeming humour of his speeches."

Cook presented each with a string of beads and a medal. A second party of natives, including some women, also visited another party from the ship who were getting wood elsewhere.

Cook gives details of his bearings, and corrects a few minor errors of Furneaux, but fails to notice the great mistake concerning the position of Maria Island and Frederick Henry Bay which Furneaux had made.

The ships eventually sailed from Adventure Bay on the thirtieth of January, and reached New Zealand ten days later.

On January 7th, 1788, (18a) the First Fleet on the voyage to form the first settlement in New Holland sighted the Mewstone, a typical landmark for the early navigators. The westerly breeze failed them, and they were compelled to lay well off shore in order to weather the outlying rocks off the Coast of Bruny. From this time (18b) onward, particularly until the discovery of Bass Straits, there were vessels passing to and from the new settlement. Certain of these, and of the whaling ships which soon followed, probably anchored off the shores of Bruny.

In August, 1788, Captain Bligh anchored in Adventure Bay in the *Bounty*. He had previously visited the locality as Cook's sailing master on the *Resolution* in 1777, and it was only natural that he should continue to perpetuate the error of Furneaux as regards the position of Frederick Henry Bay. The voyage of the *Bounty*, culminating with the mutiny at Tahiti and Bligh's famous voyage in a small open boat, has become historic. We will therefore deal more fully with Bligh's observations when

(18a) The First Fleet consisted of the Transports *Alexander* 453 tons, *Scarborough* 418, *Charlotte* 346, *Lady Penrhyn* 338, *Prince of Wales* 334, *Friendship* 228 The storeships *Fishbourn* 378, *Borrowdale* 272, *Golden Grove* 331. H.M.S. *Sirius*, 20 guns, 520 tons, and H M. Brig *Supply*.

(18b) At this time practically nothing was known of Australia beyond a few Coastal features. The following extract from Governor Phillip's Commission is of interest:—

"We . . . . appoint you to be Governor of our territory called New "South Wales, extending from the northern cape or extremity of the "coast called Cape York, in the latitude of 1[illegible] 37′ south, to the "southern extremity of the said territory of New South Wales or South "Cape, in the latitude of 43° 39′ south, and all the country inward "to the westward as far as the one hundred and thirty-fifth degree of "longitude" (See Historical Records of Australia, Series I, Vol. 1.)

discussing his later voyage in 1792, when he again called at Adventure Bay when on the way to make his second attempt to transplant the bread fruit trees to the West Indies.

The manuscript of log and narrative of Bligh's second voyage is in the Mitchell Library, Sydney, and I am indebted to Mr. H. Wright, the librarian, who kindly arranged for me to obtain copies of Bligh's writings. During my last visit to Sydney I was also enabled to examine the sketches, etc., relating to the visits to Adventure Bay. From Bligh's account we learn that he arrived off the South-West Coast at sunrise on the 8th of February, 1792, and twenty-four hours later anchored in Adventure Bay. As soon as the ships were moored a start was made in order to obtain fresh supplies of wood and water. Owing to adverse weather conditions, the efforts to obtain fish by means of the seine were unsuccessful, but many fine rock-cod were secured by line fishing, and good sport obtained catching the bream in the lake near the beach. Most of the time of the crew was occupied in getting the wood and water. Bligh was prevented from carrying out several excursions on account of the bad weather, and although it was February the fact is mentioned that snow lay on the "high Table-"land" (i.e., Mt. Wellington).

One of the proposed expeditions, if carried out, might have had far-reaching results, for Bligh, under the impression that the water of the Channel (which he could see from Adventure Bay) was the Frederick Henry Bay of Tasman, was anxious to examine the entrance to the Bay. He naturally considered this to be further to the north—beyond the Cape Frederick Henry (of Furneaux). Bligh proposed to take the smaller vessel of the two (The *Assistant*) and "go round into the Bay of Frederick Henry." Had not bad weather prevented this design being carried out, Bligh would undoubtedly have carried his explorations to the extent of circumnavigating Bruny Island, and therefore have been the discoverer of the Channel, which, owing in the first place to an accident, the French Admiral D'Entrecasteaux was to discover a few months later. By discovering is meant the discovery of the fact that it was a channel and not a bay already named. Bligh and other previous visitors to Adventure Bay had seen the central portion of the Channel before the French investigated it. Bligh's narrative states—"Lieut. Bond and others of our "gentlemen walked along the west shore as far as the "South part of Frederick Henry Bay. From the view he "had of it he gave me the following account.

"The Bay of Frederick Henry is separated on the South

"and East from Adventure Bay by a long narrow neck of "land, which in some parts is only 250 or 300 yards across. "To the N.E. it forms a high peninsula extending to the en-"trances of these two bays. To the North and West is the "main land. The greatest extent is about eight miles from "North to South, and about half the distance across. It "has a small island in the middle, and is perfectly land-"locked. From the shore of the Isthmus is a bank on "which are numerous oysters and muscles. The muscles "were larger, but not so good as those about Adventure "Bay." "The harbour is fine and capacious, perfectly "free from surf, while on the East side of the Isthmus the "sea broke with great fury."

Bligh also refers to the "wigwams" of the aborigines. He describes these as being in the form of a perfect section of a beehive, the open part to the N.E. The covering was large pieces of bark, but was neither wind nor water-tight. Around these temporary shelters were scattered many mussel shells and the remains of crayfish, also handfuls of fine shavings, and a bundle of bark about two feet long intended for a flambeau. The wigwam was capable of covering about six people. Bligh himself was unable to personally interview any of the aborigines, but some of the crew met several bands of natives in the bush, and as a result of their observations they reported that the women wore a vestige of clothing in the shape of strips of animals' skins, but that the men were quite naked. The latter had thick bushy beards, but "no paint or dirt was observed about their skins, nor "was the women's hair cut in the manner described by "Capt. Cook." The natives were armed with short sticks ("waddies") and spears about ten feet long.

Bligh deals to a small extent with the natural history of the locality. One of his descriptions is of great interest, as it is probably the earliest record of the Tasmanian "Porcupine-Anteater" (*Tachyglossus* (*Echidna*) *aculeata* var. *setosa*). Bligh records that on February 18th, 1792, "Lieut. Guthrie in excursion to-day "killed an animal of very odd form. It was 17 ins. long "and the same size round the shoulders, to which rather "a small flat head is connected so close, that it can "scarcely be said to have a neck.—It has no mouth like "any other animal, but a kind of Duck Bill, 2 ins. long, "which opens at the extremity, where it will not admit "above the size of a small pistol ball.—The tongue is very "small. It has four legs which carry the belly about an "inch or two from the ground, and on each fore foot it has "three very strong claws an inch long and two about a "quarter of an inch. On the hind feet, it has the same "number, but they resemble more the thumb and fingers

"of a hand, except that the fore claw is longest and curved. "The eyes are remarkably small and just above the beak. "It has no tail, but a rump not unlike that of a pen-"guin, on which are some quills about an inch long, as "strong as and like those of a porcupine—these quills, "or rather prickles, are all over its back amidst a thick "coat of rusty brown hair; but the belly is of a light "greyish colour. The skin is remarkably white."

On the 19th sufficient wood and water had been secured, the ships were ready for sea, but were detained on account of the absence of one of the crew of the *Assistant*. Finally leaving the bay on the 22nd of February, Bligh states that being anxious to know something of "the entrance into "Frederick Henry Bay" he steered three leagues to the north, but was prevented from going further owing to the southerly breeze freshening. He accordingly hauled to the wind and proceeded on his voyage to Tahiti. (18c)

In 1791 the French nation became anxious concerning the fate of La Perouse, who had not been heard of for three years. It was eventually decided to send out an expedition to see if any trace could be found of the *Bouffole* and *Astrolabe*. As a result the ships *Recherche* and *Esperance*, under the command of Admiral Bruny D'Entrecasteaux, left Brest in September, 1791. (19) The complement of the former vessel was one hundred and thirteen, and of the *Esperance* (commanded by Capt. Huon Kermandec), one hundred and six (20)

After touching at several places, including the Cape of Good Hope, the vessels arrived off the Coast of Tasmania, (21) and on April the twenty-first, 1792, the Mewstone was sighted. It had been the Admiral's intention to anchor in Adventure Bay, but owing to an accident (22) he was confined to his cabin and was obliged to give orders respecting the navigation according to the observations reported to him. Upon nearing the land Pilot Willaumez was directed to take the necessary observations, and on being asked the bearings of the Eddystone Rock he gave it as S. 19 degrees W., though it was actually S. 19 degrees E D'Entrecasteaux therefore gave orders to make for the bay on the left, thinking that this was Adventure Bay. In this manner the Channel which now bears D'Entrecasteaux's name was discovered.

(18c) Bligh's MSS.—The Mitchell Library, Sydney, N.S.W.

(19) Labillardiere. Voyage in search of La Perouse. (Trans 1800) Intro.

(20) Of the 219, as many as 99 had died before the vessels had reached the Isle of France on the return journey.

(21) Then V.D.L., or the southern extremity of New Holland.

(22) During a storm on the 14th of April he had been thrown "against "one of the corners of a barrel organ intended as a present for some "savage chief."

When the ships entered the opening in the coast, Labillardiere states [23]: "In vain we looked for Penguin's "Island, thinking ourselves in Adventure Bay, though it "really was Tempest Bay, named thus by Tasman, who in "having entered it in the month of November, 1642, was "in the most imminent danger of being driven ashore by "a S.E. wind when he endeavoured to get into the main "sea." [24] The French vessels eventually came to anchor in the entrance to the Channel, and the following day, after the boats had been sent out and discovered a sheltered harbour, [25] the ships were gradually towed towards it, but failed to reach the intended anchorage before dark. A boat which had been sent out fishing "took so "many at a single draught of the net that a distribution "was immediately made, and every one contented with his "portion."

Labillardiere states that a few wild dogs were seen in the neighbouring country. As the dingo did not reach Tasmania, it is a matter for conjecture as to what animal is referred to—probably *Thalacinus*.

Whilst the ships lay at anchor two boats were sent out to "reconnoitre the north-east side of Tempest Bay as "far as Cape Tasman." They returned at the end of four days, and it appeared from the result of their observations that "Tasman's Headland and the coast of Adventure "Bay make part of an island separated from Van Diemen's "Land by the sea. After they had gone up the Channel as "far as 43 degrees 17 min. S. lat. they were obliged to re-"turn for want of provisions."

For nearly a month the explorers stayed in the sheltered waters of the bay, and on the evening of the 17th of May, 1792, the *Recherche* and *Esperance* entered the Channel proper—"to which we gave the name of our "Commander, D'Entrecasteaux." Two days later Labillardiere records landing on an island [26] which bounds the Channel through its entire length. A boat from the *Esperance* had passed the night at the same place, and had taken a large haul of fish. The French Naturalist records the collection of a number of plants new to science, most of which "belonged to the genus of *Melaleuca*, *Aster*, "*Epacris*, etc."

A small island situated S. 42 degrees W. of the second anchorage was denominated Partridge Island by

(23) Labillardiere—Voyage in search of La Perouse. (Trans. Lond. 1800.)

(24) Labillardiere was perpetuating Furneaux's error, and presuming the mouth of the Channel to be Storm Bay. Labillardiere is also in error as regards the S.E. wind. Tasman was preparing to anchor in what is now known as Adventure Bay, but was blown to sea by a N.W. gale.

(25) Now known as Recherche Bay.

(26) Bruny Island.

some of the crew who discovered it, owing to the number of quail seen there. These were mistaken for partridges. Two of the ship's officers, who had landed further to the North on Bruny Island, saw several natives who fled at their approach. The aborigines left behind baskets made of rushes, some of which were filled with shell fish and others with pieces of "flint" and fragments of the bark of a tree, as well as several Kangaroo skins and drinking vessels made of the leaves of kelp.

On the 23rd of May, the pinnace, which had been sent out on an exploring expedition returned after having surveyed the whole length of the Channel. Following on this survey the larger vessels were navigated through the strait, and on the 28th of May they sailed from the Channel after having completed a geographical discovery of great importance. The historian of the voyage states that—"The season was advanced and the thermometer had "not yet been lower than 70 degrees above 0, although we "were near the 44th degree of S. latitude. Impetuous "winds reigned in the open sea, while in the strait (27) "we enjoyed the greatest tranquillity. We did not expect "to experience so much security near the Bay of Tempests." (28)

After circumnavigating Australia the *Recherche* and *Esperance* arrived off the South West Coast for the second time in January, 1793. Both ships needed repairs, and the water supply had run very short, so it was resolved to again steer for Van Diemen's Land. They sighted Tasmania on the 19th, and four days later came to anchor in the "Bay of Rocks" at the south end of Recherche Bay, where they remained until the 15th of February. While here various repairs were carried out, and it is recorded that the trials made the year before of the wood of the *Eucalyptus globulus* (Blue Gum) induced the carpenters to employ it in preference to the other species of the same genus.

Many excursions were made ashore and several boat expeditions sent out. On their passage up the Channel the ships were compelled to anchor on several occasions, and on the 15th of February a party from the ships landed on Bruny Island "on some low ground, whence it was easy to reach Adventure Bay in a short time. On the 18th a start was again made, but several natives being seen on the island a number of the ships' company set out to interview them. The aborigines gave the French to understand that they had seen ships before in Adventure Bay. The French vessels were detained by contrary winds, and it took them several days to work clear of

(27) D'Entrecasteaux Channel.
(28) Storm Bay.

the Channel. On the morning of the 24th, however, they were safely brought to anchor in Adventure Bay, where they remained until the first of the following month. Whilst in this locality a raft made of bark, as used by the natives, was found on the shore, and traces were found of Bligh's visit of the previous year. Several inscriptions engraved on the trunks of trees indicated that Bligh had anchored there in February, 1792. The botanists of Bligh's vessel had sown, at a little distance from the shore, cress, acorn, celery, etc. The French saw three young fig trees, two pomegranate trees, and a quince tree, which they had planted, as well as an apple tree, "the stem "of which was near six and a half feet high." Labillardiere dwells upon the fact that an inscription recorded that "Near this tree Captain William Bligh planted 7 fruit "trees, 1792. Messrs. S. & W., Botanists." The aspect which the Frenchman draws attention to is that although the name of the Commander is mentioned the botanists have only their initial inscribed. But it must be remembered that Labillardiere was himself a botanist, and that, to judge from his writings, he was often at variance with the ship's officers concerning the exact status of the scientific staff.

An interesting relic of D'Entrecasteaux's visit to Adventure Bay is drawn attention to by West (29) who states—"Letters buried in a bottle beneath a tree in Ad-"venture Bay were found by Captain Bunker of the *Venus* "in 1809, to which he was directed by the words 'dig "'underneath,' and supposed, from his imperfect know-"ledge of the language, that they were left by Perouse. In "this he was mistaken; they were deposited by D'Entrecas-"teaux at his second visit. *Bent's Almanac*, 1828, adopted "Bunker's mistake; it was copied by Widowson, who adds— "'these letters were dated one month after his departure "'from Port Jackson, and led to the opinion that the Ex-"'pedition must have perished on some reefs of V.D.L. In "'consequence of this idea the French Government in 1791, "'etc.' The first mistake can be allowed for; but not that "a discovery of letters in 1809 prompted by an expedition "in 1791." Even recent writers have stated that there is some evidence to show that La Perouse visited Tasmania, but they could not have been in possession of all the facts.

On the 25th of April, 1793, only a few weeks after the departure of the French vessels, Commodore Sir John Hayes arrived off the South Coast of Tasmania in command of the ships *Duke of Clarence* and *Duchess*. (30) His charts show that he passed outside the Mewstone and

(29) West—History of Tasmania. Launceston. 1852. Vol. I., p. 11.

(30) The *Duke of Clarence* was a ship of 250 tons, and the *Duchess* an armed snow of 100 tons (a snow was very similar to a brig).

Eddystone rocks and endeavoured to anchor in Adventure Bay, but that neither of the ships was able to beat into it owing to contrary winds. Hayes sailed on and eventually entered the Derwent. (31a) He was unaware that the French, under D'Entrecasteaux, had recently explored this locality, and he re-named a number of places to which the French had already afforded designations. One so treated was the Isle Willaumez, which Hayes named Betsey Island. (32) Hayes' ships ascended the Derwent as far as Mt. Direction, (31b) and his boats still further. Traces of his visit are retained by such names as Risdon (33) and Ralph's Bay. (34)

The English ships sailed down the Channel and returned to the Derwent. Many places on the western shore were named, and a chart of the Channel and Bruny Island drawn up. Hayes' charts (35) show that what we now know as Bruny Island he called "Rt. Honourable "William Pitt's Island." The most northern point (the correct Cape de la Sorti of the French) (36) was named Point Hodgson, the present Barnes Bay, Port McCluer, (37) while the S.W. point of the northern half of the island was named Point Capon. Green Island (the Ile Verte of the French) was designated Pelican Island, and Isthmus Bay, Henry Hall's Harbour. (38) Satellite Island was called Sutherland's Island. Hayes missed La Petite Anse of the French, but to La Grande Anse (now Great Taylor's Bay) he gave the name Ray Taylor's Bay, (39) and to Partridge Island (L'Ile aux Perdrix), Thistleton's. Island. (40) The small islands or cluster of rocks off the South West Coast of Bruny Island he called Court's Islands, (41) and the point opposite Partridge Island, Point Collins. The Acteon Islands (the Iles Steriles of the French) became Fawcett Isles.

(31a and b) So called by Hayes.

(32) After the ship *Betsey* (Lee). Like many other place names, the designation of Betsey Island has been the subject of romantic tales. The island is often called Franklin Island at the present time, owing to the fact that Lady Franklin purchased it The island is now the property of the Trustees of the Tasmanian Museum and Botanical Gardens.

(33) Risdon—so called by Hayes, after Wm. Bellamy Risdon, 2nd officer of the *Duke of Clarence.* (Lee.)

(34) Called Relph's Bay by Hayes, after Wm. Relph, Commander of the *Duchess.* The French had given the appropriate title of Double Bay to this locality.

(35) There are several copies, but in this instance we will deal with the copy of the MS. chart in the Admiralty collection. See copies in Mrs. Lee's work, "Commodore Sir John Hayes"

(36) On some charts the position of C. de la Sorti (C. Farewell) is shown too far to the south east.

(37) After John McClure, a Bombay marine officer.

(38) Henry Wallis on later copies.

(39) After Captain Taylor, Bombay marines.

(40) After his old chief, the captain of the *Drake.*

(41) Thomas Court was 1st officer of the *Duke of Clarence.*

To the Channel itself Hayes apparently gave the name of Seton Strait. Mrs. Lee, in describing (42) Hayes' charts states that "Esperance Bay, discovered by the boat "sent out from the *Esperance* and named in honour of the "French ship, is designated A. Adamson's Harbour. The "smaller indentation on its northern shore Hayes named "A. H. Bogle's Bay in memory of Dr. Alexander Bogle, a "former messmate who served on the *Drake* . . . . . . "What is most extraordinary with regard to the western "shore is the complete omission from the charts of the "great opening which forms the mouth of the Huon "River. One can only suppose that when sailing down "the strait and returning up it, Hayes missed seeing any "part of the opening."

Anyone conversant with the locality would naturally wonder at such a prominent opening being missed, and a detailed examination of Hayes' charts shows that he not only noticed it, but sailed into the estuary of the river now known as the Huon. The harbour Hayes missed charting was Port Esperance, which might be easily missed from a distance owing to the surrounding hills, and the "A. Adamson's Harbour" of his charts is undoubtedly the mouth of the Huon. Hayes' ships sailed up the river, at any rate a little to the west of Huon Island, which Hayes charts as Jameson's Island. He also refers to Arch Island as Bridge Rock.

After exploring the Channel and the River Derwent Hayes left Tasmania on June 9th.

Flinders and Bass in the *Norfolk* (a sloop of 25 tons) during the voyage in which they conclusively proved that Tasmania was an island, arrived off the entrance to the Channel on the evening of December 13th, 1798. Flinders was mainly working on Hayes' chart of V.D.L., of which he had a copy, but it must also be remembered that Flinders had visited Bruny Island in 1792 when serving as a midshipman on the *Providence* under Bligh. (43)

Owing to the squally westerly weather the little vessel stood off and on during the night, and in the morning it was found that her position was far to leeward. Giving up the idea of entering the Channel the explorers bore up for the Boreel Islands (Friars of Furneaux). Of these islands Flinders states that three of them produced some vegetation, and that that of the largest had been recently burnt off. Flinders had observed also that the vegeta-

(42) Commodore Sir John Hayes By Ida Lee. London, 1912.

(43) It is interesting to note that Bligh served under Cook, Flinders under Bligh, and later, when Flinders was in command of the *Investigator*, Franklin served under him as a midshipman. Sir John Franklin afterwards became Governor of Tasmania.

tion on the Maetsuycker [44] Islands had been treated in a similar manner, although these rocky outposts are situated several miles from the mainland. This is of interest as showing that the natives used to visit the islands lying off the coast in spite of the fact that they only possessed rough rafts of bark in which to make the journey. The aborigines must have crossed D'Entrecasteaux Channel regularly in their frail vessels in the same manner as they used to visit Betsey, Maria, and other islands off the coast.

Passing Fluted Cape, Flinders was unable to fetch into Adventure Bay, so stood on, intending to enter the Derwent, but as the Henshawe Bay of Hayes appeared to be a very large opening, and the wind was not favourable for entering the river, Flinders sailed on and finally anchored in a sheltered bay. [44a] Flinders did not enter the Derwent until December 23rd, and on Xmas afternoon, 1798, he sailed the sloop up as far as an inlet above Mt Direction. Flinders named this bay Herdsman Cove.[45]

Here the explorers stayed until the end of December and spent the last day of the old year, and the first of the new in beating down the river. On January 2nd, as the wind was strong S.E., they ran into the Channel and anchored in Pruen Cove [46] (of Hayes). On the 3rd they sailed from the Derwent estuary and passed Cape Pillar late in the afternoon. [47]

On the 13th of January, 1802, Admiral Baudin, in command of *Le Geographe* and *Le Naturaliste* arrived off the South Coast of Tasmania, and shortly after noon were near the entrance to the Channel, the weather being stormy with rain showers. Péron records that "boobies "and gulls, and cormorants, and sternæ from the neigh-"bouring rocks in countless legions flew around our ships, "and mingled their piercing screams with the roaring of "the angered waves; a long file of white mozzled dolphins, "with many others of the cetaceous tribe, performed their "evolutions around us." At 4.30 p.m. the ships anchored in 23 fathoms a mile to the west of Partridge Island, From this base several boat expeditions were sent out. One boat from *Le Geographe*, which visited Bruny Island,

(44) In the Tasmanian Museum there are aboriginal crania which were obtained from Maetsuycker and Tasman Islands.

(44a) Now generally known as Norfolk Bay—so called after Flinders' vessel.

(45) "From the pastoral appearance of the surrounding country."—Flinders.

(46) Now Oyster Cove.

(47) Cape Pillar has been stated to be one of the names bestowed by Flinders to prominent coastal features. Cape Pillar, however, was shown by Cox (who visited Tasmania in the *Mercury* in 1789) on his chart, which was published in London in 1791.

met with a number of natives. On the 17th the ships proceeded further into the Channel, but a calm caused them to anchor in 9 fathoms off Cape Ventenat. Péron records that "On the 19th at six in the morning we again made "sail for the North-West Port, in which we proposed an- "choring, and passed in succession Satellite Island, Rich "Point, (48) the Bay of the Isthmus, Cape Legrand, (49) "and Gicquet Point." (50)

The following day, owing to a fishing excursion in the vicinity of Bruny Island, the naturalist of the expedition records the capture of "more than twenty new species "of fish." "I likewise collected 12 or 15 species of new "and very curious conchæ, among which was *Trigonia "antarctica*, N., a species which hitherto was not supposed "to have existence and of which in our climates are many "very extensive banks in a petrified state."

From the anchorage in North-West Bay numerous boat expeditions were made to Bruny Island, the River Derwent, and other places of interest. The vexed question of the correct position of Tasman's Frederick Henry Bay was settled, and the French explorers drew up admirable charts showing the results of their investigations.

Several interviews were had with the natives on Bruny Island. On one occasion a party of native women were met with, who were returning from fishing. The shell fish were carried in bags made of rushes, the bags being fastened round the forehead by a band, and hung down the back. Some of the bags were of great weight.

The ships sailed from the Channel on the 17th of February. Baudin, however, returned to Adventure Bay for a few days in May of the same year. *Le Geographe* had become separated from her consort, and it was with great difficulty that Baudin managed to finally reach Port Jackson, where *Le Naturaliste* had been for some time. In view of the controversies that have taken place concerning the treatment given to French at Port Jackson, Flinders' detention for six years at Mauritius, and the general idea governing the French voyages of discovery generally, Péron's reports make interesting reading. As apart from the naturalist and, owing to the death of Baudin, the historian of the voyage, he frankly confesses himself as a spy. His report (51) on the settlement at Port Jackson, which he furnished to General De Caen, throws an entirely new light on his character.

(48) Named after Riche, the naturalist of the *Esperance* Now known as Simpson Point.

(49) Named after Legrand, ensign of the *Esperance*. Now known as Kinghorne Point.

(50) Now known as Snug Point (the S.W. Point of N.W. Bay).

(51) For a translation of this report, see Professor Scott's work, "Life of Matthew Flinders," Appendix B., p. 437.

The year after the departure of the French, the *Lady Nelson* and the *Albion* arrived at Risdon, and laid the foundation of the English settlement of our Island State. With the advent of settlement and the stirring era of the whaling days, the island of Bruny was concerned to some extent. This period of its history, however, does not belong here and must remain to be told on some future occasion.

NOTES ON THE NOMENCLATURE OF BRUNY ISLAND.

Actæon Islands. So named from the fact that the ship *Actæon* was wrecked there in November, 1822. There have also been other wrecks in this locality, for instance, the ship *Wallace* in 1835.

These islands had been named the Sterile Isles by the French, and Fawcett Islands by Hayes. The present Admiralty charts show the larger island as Actæon Island, and the smaller as Sterile Island. D'Entrecasteaux named them the Sterile Isles in 1792.

Adventure Bay. So named by Furneaux after his vessel the *Adventure*, which anchored in the bay in 1773.

Arch Island. L'arche of D'Entrecasteaux and Bridge Rock of Hayes.

Apollo Bay. Probably named after the brig *Apollo* (built by Griffiths). The *Apollo* was lost off Maria Island in 1835.

Bad Bay. Commonly known as Cloudy Bay. La Baie Mauvaise of the French.

Barnes Bay. In Ross' Almanack for 1829, Barnes Bay is referred to, so the designation had been bestowed before that date.

Betsey Island. Originally called Willaumez Island by D'Entrecasteaux. Hayes, unaware of the French discoveries, anchored his ships near here in 1793 and re-named it Bestey Island after the ship *Betsey* (at one time commanded by Captain Megson, a friend of his). The island is sometimes referred to as Franklin Island. Lady Franklin purchased the island in 1840. She later vested it in Trustees for the use of the Acclimatisation Society, and after being used for such purposes for many years, it was vested by Act of Parliament (1903, No. 42, s. 15) in the Trustees of the Tasmanian Museum and Botanical Gardens. The island had been used in the twenties for acclima-

tisation purposes, for there are records (52) of silver haired rabbits, pheasants, and peacocks being on the island.

Blanche Rock (Channel). D'Entrecasteaux charted this as "R. Blanc" ("The White Rock"). An additional "he" has, at some period, been added to the French name, and the rock is usually charted as Blanche Rock.

Boreel Islands. Now known as The Friars. Called the Boreel Islands by Tasman in 1642 after a member of the Council of India. Furneaux mistook their location and re-named them The Fryars, which designation, with a slight alteration in the spelling, is now in general use.

Bruny Island. So named after Admiral Bruny D'Entrecasteaux. During the course of its history the locality has been referred to as Bruné and also Bruni, but the correct spelling of Bruny is now in general use. In the early days the island was also called Pitt Island, and some of the early land grants (i.e., Kelly's, 1818) refer to it as Pitt Island. (See notes on Hayes' visit to Tasmania.)

The "Lunawanna-allonah" of the Tasmanian aborigines.

Bull Bay (Shelah Cove). The correct name of this Bay is Shelah Cove, as this designation appears on charts of 1818, and the name Bull Bay was not given until later. Probably named after Captain Bull This was a noted whaling station in the early days of last century. Ross, in 1830, writing of this locality, states—"Another is called Bull "Bay, being a great resort of boats in the whal- "ing season." The establishments belonged to several whalers in Hobart. (See Shelah Cove.)

Cape Connella. Furneaux referred to the Cape at the south end of Adventure Bay as Fluted Cape. D'Entrecasteaux accepted this designation, refers to it as Cap Cannelé ("Fluted"). Changes have appeared in maps from time to time, and the name Fluted Cape now appears on the charts as the point at the south end of Adventure Bay, while a point a mile or so further to the south has been designated "Cape Connella"—obviously an adaptation from the French Cap Cannelé, which was identical with Fluted Cape.

(52) Bent's Almanack, 1829.

Cape de la Sorti (Cape Farewell). So named by the French as their ships were leaving the Channel. Its original position has been moved, and is shown too far to the East on modern charts. The present Kelly Point is the correct Cape de la Sorti of D'Entrecasteaux.

Cape Frederick Henry. So named owing to Furneaux considering that the Frederick Henry Bay of Tasman was situated a few miles to the north of this point. D'Entrecasteaux refers to this cape as Cap Trobriand.

Cap le Grand (of D'Entrecasteaux). Now known as Kinghorne Point.

Cloudy Bay (Bad Bay). La Baie Mauvaise of D'Entrecasteaux.

Court's Islands. So called by Hayes in honour of Captain Thomas Court, First Officer of the *Duke of Clarence.*

D'Entrecasteaux Channel. Named after Admiral D'Entrecasteaux. Hayes first referred to it as Pruen Strait, but named it Seton Strait on his charts.

Eddystone Rock. So called by Captain Cook during his third voyage in January, 1777. He refers to it as follows—"About a league to the Eastward of "Swilly is another elevated rock that is not taken "notice of by Captain Furneaux. I called it the "Eddystone from its very great resemblance to "that lighthouse."

Fluted Cape. Has been ascribed to Hayes (1793), but Furneaux (1773) refers to it as a fluted pillar, and Anderson's account (1777), published in Cook's Voyages, refers to "Fluted Cape." Appears on D'Entrecasteaux's charts as Fluted Cape or Cap Cannelé. See note re Cape Connella.

Friars. See Boreel Islands.

George III. Rock. So called because the George III. was wrecked there in 1835. One hundred and thirty-four people were lost out of a total of two hundred and ninety-four. Upon Southport Head there is a stone monument which has the following inscription:—

"Near this place are interred the remains of many of the sufferers who perished by the wreck of the George III. convict ship, which vessel struck on a sunken rock near the Actæon Reef on the night of 12th April, 1835, upon which melancholy occasion 134 human beings were drowned. This tomb is erected by the desire of His Excellency

Colonel George Arthur, Lieutenant-Governor, to mark that sad event. and is placed on this spot by. Major Thomas Ryan, 50th Regiment, one of the survivors upon this occasion."

Green Island. The Ile Verte of D'Entrecasteaux. This island is referred to by Bligh, who mistook the Channel for Frederick Henry Bay. In the MSS. account of his voyage in 1792 (Mitchell Library, Sydney), Bligh states in his description of the view from Penguin Island —"From the heights "of the island, Frederick Henry Bay can be seen "distinctly, and an island in it bore N. 30 W." See also Bond's description of "Frederick Henry "Bay" in Bligh's MSS.

Great Taylor's Bay—Little Taylor's Bay. A curious blending of the French and English nomenclature is apparent in this case. D'Entrecasteaux refers to the larger inlet as "La Grande Anse," and the smaller as "La Petite Anse." Hayes simply charted one bay. calling it Ray Taylor's Bay (after Captain Taylor, Bombay Marines).

Kelly Point. The correct Cap de la Sorti of the French. Called Kelly Point after Captain Kelly, the discoverer of Port Davey, who was the pilot for the Derwent, and had a farm at this point in the twenties. Ross (1829) refers to the beautiful farm of Mr. Kelly, and on the opposite coast to the farm and tobacco gardens of Mr. Joshua Ferguson at Tinder Box Bay. In 1830 there was a station situated about three miles to the south of Mr. Kelly's farm where rations were issued to the natives.

Kinghorne Point. The Cap le Grand of D'Entrecasteaux's chart. From the letterpress evidently originally intended as Cap Legrand, after Ensign Legrand of the *Esperance*. Like Kelly Point, the early French designation gave way to that of the first settler. Mr. Kinghorne had a farm in this locality in the twenties. I have not been able to trace if he was identical with the Mr. Kinghorne who was at one time master of the colonial schooner *Waterloo*.

Lunawanna. Lunawanna-allonah was the Tasmanian native name for Bruny Island. The names have now been given to two separate districts of South Bruny.

Mewstone. So named by Furneaux on 9th of March, 1773. "About four leagues along shore are three islands "about two miles long, and several rocks resem-"bling the Mewstone (particularly so one which we "so named)"—"Cook's Voyages."

Partridge Island. L'Ile aux Perdrix of the French. So called owing to the sailors mistaking the quail seen there for partridges. Called Thistleton's Island by Hayes. Ross (1836) referring to this locality states that the ship *Enchantress,* Captain Roxburgh, from London, was wrecked on a rock about seven miles from the island in July, 1835, and seventeen people drowned.

Pedra Branca A large rock off the entrance to D'Entre-casteaux Channel. So named by Tasman on 29th November, 1642, owing to its likeness to a similar rock off the coast of China. Furneaux re-named this and the adjacent rocks the Swilly Isles, but this designation has lapsed.

Penguin Island. Named by Furneaux owing to a curious penguin captured here. (53)

Pitt Island. Hayes named Bruny Island the Rt. Hon. William Pitt's Island, and in the very early days of the Colony the island was often referred to as Pitt Island.

Roberts Point. Bent, writing in 1825, refers to the soap and salt factory at Bruny Island, of which Mr. R. A. Roberts was the proprietor. Ross (1829) refers to Mr. Roberts' salt factory at Barnes Bay, and later (1834) refers to the fact that "Con-"siderable exertion has been made within the last "2 or 3 years by Mr. Roberts, the soap manufac-"turer, to open up a coal mine at a convenient "place for shipping, on the border of the Derwent, "about 30 miles below Hobart Town." The locality referred to would probably be the south end of Adventure Bay. If so. Adventure Bay would appear to have been the first part of South Bruny to receive permanent settlers, for Ross, writing in 1830, stated that South Bruny was then little known. No one resided upon it, and except for occasionally a few wandering natives from the northern part of the island, it was quite uninhabited.

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(53) See Hull. Rec. Aust. Mus., Vol. XII., No. 6. On the occurrence of the Crested Penguin (*Eudyptes chrysosome*) in Australia.

Satellite Island. D'Entrecasteaux charted this island as "I. du Satellite." It is often referred to at the present day as Woody Island, but this latter designation is incorrect. The true Woody Island is the one in Norfolk Bay, which was so named by Flinders.

Shelah Cove. Commonly known as Bull Bay. Upon a plan dated 1818, locating certain land to James Kelly, the Bay is designated Shelah Cove. (54) The plan is filed at the Lands and Survey Office, Hobart. Bruny Island was apparently then called Pitt Island. (See Bull Bay.)

Simpson Point. Point de Riche of D'Entrecasteaux. Riche was a naturalist on the *Esperance*.

Snake Island. I have been unable to trace the original date of this designation, but there is an interesting note regarding the early history of this small isle in a book of sketches relating to "The Voyage "of H.M.S. Britomart, from 1834 to 1843." This MS. volume is in the Library of the Royal Society of Tasmania, and there appears a sketch entitled, "Mr. Cole's House. Snake Island. D'Entrecasteaux Channel." In a note relating to the sketch appears the following:—"About ten "o'clock one dark night, about a fortnight previous "to our visit to the island, four convicts who had "escaped from Port Arthur in a whale boat landed "there. On arriving at the only house on the is- "land they found the owner of it, Mr. Cole, an "old man who had served in the army in his "younger days, sitting before the fire, and his "daughter, a fine strapping girl of 18, just going "to bed. Leaving two of the party, one of "whom was armed with a gun, to guard the father, "the other two obliged Miss Cole to show them "where the stores and provisions were kept. "While they were employed collecting what they "had wanted, Mr. Cole contrived to get posses- "sion of a knife that had been left on the floor "after supper unperceived by the two men who "were left to guard him. He then watched his "time, and striking up the muzzle of the musket, "rushed upon the man who held it, and wounded "him very severely. The second man came to "the rescue and received so severe a wound that "he died soon after. The other two men, alarmed "by the noise of the scuffle, now came in from

(54) I am indebted to Mr W. N. Hurst, Assistant Secretary for Lands, for this information.

"the store room, and succeeded in throwing Mr. "Cole down and would have strangled him had he "not received an unexpected relief from his son "and daughter. The former, a boy of 14, came in "armed with a heavy New Zealand club, with "which he dealt one of the assailants such a blow "as to stun him, and Miss Cole managed to drag "the other man, who had been wounded, away from "her father, who was too much exhausted to pre- "vent them getting away in their boat, but they "were taken next morning. One died from his "wounds, and the rest were hanged."

Storm Bay. So called by Tasman. On the evening of November 29th, 1642, he was making into the bay, evidently intending to come to anchor in Adventure Bay, when a nor'-west gale blew his ships to sea again.

Tasman's Head. Apparently owes its designation to Furneaux, as it first appears on Cook's chart. It is very difficult to reconcile the location noted by Furneaux. It must be remembered, however, that Furneaux was in all probability working on an indifferent copy of Tasman's charts, and also that the published accounts of the English captain's visit to Tasmania may have suffered when his notes were being revised for publication. The account also gives one the impression of having being written as the events happened, and various corrections made later. Furneaux states that upon sighting land they took the first point seen to be the South Cape. Now Tasman's South Cape (Zuyd Caep) is the present Cape Pillar. As he proceeds eastwards and passes the entrance to the Channel, Furneaux thought he was passing across Tasman's Storm Bay. The question naturally arises, how did he come to think that Storm Bay was east of South Cape? (55) If he really thought he was crossing Storm Bay, and was in possession of a copy of Tasman's chart (as he states he was), he would have noticed that Tasman had called the island at the eastern extremity "Tasman's Island." Furneaux, however named the islands (The Boreel Islands of Tasman) at the eastern extremity of what he

(55) This also explains the present nomenclature of South Cape, S.W. Cape, and S.E. Cape on the mainland. They owe their designation to Furneaux, but the original (1642) South Cape is the present Cape Pillar.

took to be Storm Bay, as The Friars. He eventually came to anchor in Adventure Bay, thinking he was in the Frederick Henry Bay of Tasman and that the Peninsula was Maria Island. He states, however, that they found that the true Frederick Henry Bay was some miles to the north. He did not recognise that it was also further to the east, and it was this mistake that led to the confused nomenclature in use at the present day. From his anchorage Furneaux records various bearings, and mentions the north point of the Bay as the one they consider is "Tasman's "Head." I have been unable to find any reference to Tasman's Head on any of Tasman's charts or in his writings. One can only conclude that Furneaux referred to Tasman's Island, as this is shown on the Dutch charts, and is, of course, some miles to the south of Frederick Henry Bay (56) (of Tasman.) Now on the published charts of Cook's voyages, the name Cape Frederick Henry appears as the designation for the northern point of Adventure Bay, and Tasman's Head for the bold south-east extremity of Bruny Island. Apparently both designations were originally due to Furneaux's error as regards his position, and the slight correction made between the written account and the charts did not tend to improve matters.

Taylor's Bay. See Great Taylor's Bay.

Trumpeter Bay. Ross' Almanack for 1830 in describing the inlets of Bruny states "One is called Trum-"peter Bay" from the quantities of that fish caught there.

Ventenat Point. Named after Louis Ventenat, chaplain and naturalist of the *Recherche*.

Zuidpool Rock (D'Entrecasteaux Channel). Named because the ship *Zuidpool*, 536 tons, from Amsterdam, struck this rock, which was not then charted, in December, 1845. The vessel remained on the rock for six hours, but floated off with the rising tide and was not damaged. (57) The rock is often referred to as "The Dutchman."

(56) The present Blackman's Bay, East Bay Neck.

(57) I am indebted to Mr. J. Adams, Secretary of the Hobart Marine Board, for this information.

A DESCRIPTIVE CATALOGUE OF THE OSTEOLOGICAL SPECIMENS RELATING TO THE TASMANIAN ABORIGINES CONTAINED IN THE TASMANIAN MUSEUM.

By
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(Read 13th September, 1920.)

INTRODUCTORY.

During the course of the preparation of a paper dealing with certain recent valuable additions to the Tasmanian Museum it became necessary for us to revise the complete collection of the osteological specimens relating to the Tasmanian Aborigines.

This list forms a record of the largest single collection of osteological remains of the extinct Tasmanian aboriginal race. It embraces also specimens concerning which data are being gathered for publication. Again, in the course of the work additional particulars have been added to specimens already described in part. As will be seen, with the exception of the researches of Harper and Clarke and later of Berry and Robertson on certain of the crania included in this list, none of the specimens have been described. Even the complete skeleton of Trucanini (the last of her race) remains to be measured and the indices to be tabulated.

Yet again, four more crania, the property of various gentlemen and hitherto undescribed, have been located. It is the intention of the authors to proceed steadily with the work of describing in detail the more important of the specimens included in this list, together with the additional crania mentioned above.

HOMO TASMANENSIS.

LIST OF OSTEOLOGICAL SPECIMENS IN THE TASMANIAN MUSEUM.

Tasmanian Museum No. 1572. **Portion of Cranium.** ♀

Reference:—Berry and Robertson, Trans. Roy. Soc. Vic., No. 22, Vol. V. (1910).

T.M. No. 3362. (1) Cranium. ♀

(1.) T.M. No. 3362 now includes T.M. 3362-3369. The whole of the bones relating to the skeleton Waubadeba have been given the one index number—3362.

Berry and Robertson No. 9. (2) Harper and Clarke (3) No. 10 (P. and P. Roy. Soc. Tas., 1897).

This is the cranium of "Waubadeba," a fact not noted by either of the above authorities. There are also in the Museum collection additional bones relating to this specimen.

T.M. 3362 now includes the following:—

Cranium. Four fragments R. and L. superior maxillæ. Mandible (not figured by B. and R.). Scapulæ, R. and L. (incomplete). Sternum (incomplete). Ulna, R. (incomplete). Radius, L. (incomplete). Ribs, fragments, R. and L. (15). Femur, R. and L. (incomplete). Tibia, R. and L. (incomplete). Fibula, R. and L. (incomplete). Os calcis (incomplete). Astragalus (incomplete). Metatarsal, fragments (unidentified) 2.

T.M. No. 4287. Complete skeleton. ♀ "Trucanini" (the last of the race).

Berry and Robertson No. 6. Harper and Clarke No. 7.

The above describe the cranium and mandible only. As far as we are aware the remainder of the skeleton has not yet been described.

T.M. No. 4288. Cranium (complete). ♂ "Augustus."
B. and R. No. 1. H. and C. No. 1.

T.M. No. 4289. Cranium (complete). ♀ "Caroline."
B. and R. No. 8. H. and C. No. 9.

T.M. No. 4290. Cranium. ♀
B. and R. No. 14. H. and C. No. 3a.

T.M. No. 4291. Cranium. ♂
B. and R. No. 2. H. and C. No. 2.

T.M. No. 4292. Cranium. ♀
B. and R. No. 11. H. and C. No. 12.

T.M. No. 4293. Cranium. ♀
B. and R. No. 7. H. and C. No. 8.

T.M. No. 4294. Cranium. ♀
B. and R. No. 10. H. and C. No. 11.

T.M. No. 4295. Cranium. ♀
B. and R. No. 15.

T.M. No. 4296. Cranium. ♂
B. and R. No. 16.

T.M. No. 4297. Cranium. ♂
B. and R. No. 13. H. and C. 2a.

(2.) Berry and Robertson. Trans. Roy. Soc. Vic., Vol. V. (1910).
(3.) Harper and Clarke. Papers and Proceedings Royal Society of Tas., 1897.

T.M. No. 4298. Cranium. ♂
B. and R. No. 5. H. and C. No. 6.

T.M. No. 4299.—Missing.

See B and R. No. 2. T.M. 4299 is evidently H. and C.'s No. 3. Future investigations may lead to this skull being returned to the Museum collection.

T.M. No. 4300. Cranium. ♂
B. and R. No. 3. H. and Co. No. 4.

T.M. No. 4301. Cranium. ♂
B. and R. No. 4. H. and C. No. 5.

T.M. No. 4302. Cranium. ♂
B. and R. No. 11. H. and C. No. 1a.

T.M. No. 4303. Cranium. ♀
B. and R. No. 17.

T.M. No. 11509. Skull found on beach at Eaglehawk Neck and presented to the Museum by Mr. Parker, January 4, 1910. This skull is probably portion of the large collection (A (E.H.) 555-886) obtained later. Adult skull, less mandible. Very much weathered. Greater portion of R. parietal and frontal, with part of temporal bones being lost through exposure. Skull presents a particularlv carinate appearance. Parietal eminences not marked.

T.M. No. 11554. Skull from N. W. Tasmania, presented by Police Department. Skull of young adult. Very much damaged by exposure and weather. Outer table of greater portion of frontal and of portions of both parietal bones has disintegrated. Superciliary ridges wanting, as is glabella, but general configuration of skull, with its parietal eminences and superior portion of occipital bone, is typically Tasmanian.

T.M. No. A. 887. Cranium. Portion of parietal and occipital bones.

This specimen has been in the Museum for very many years. It was found at Triabunna, and presented to the Museum by Captain Vicary. Apparently not previously catalogued.

T.M. No. A. 298. Cranium (incomplete) and mandible.

The left side of this skull is fairly complete, a part of the left parietal bone being absent. The right lateral surface has probably been exposed for a considerable period, and to a large extent is completely gone. The superior and inferior maxillæ present features of unusual interest, and will be described fully in a subsequent paper. This skull was obtained from Tasman Island, being presented to the Museum by the Marine Board of Hobart in 1913.

T.M. No. A. 499. Cranium, less mandible.

Obtained from Maetsuycker Island. (4). Presented by G. H. Oates, 1916.

T.M. No. A. 500. Humerus, R. From Maetsuycker Island.

T.M. No. A. 501. Radius, R. Carpal and Meta-carpal bones, R.

These bones are ankylosed and show signs of chronic inflammation.

T.M. No. A. 506. Portion of Calvarium.
B. and R. No. 22.

T.M. No. A. 507. Frontal and other portions of skull (see B. and R. No. 23.)

To the specimen as figured have been added the right parietal bone, the right temporal bone, and other minor portions, which add considerably to the value of the specimen.

T.M. No. A. 550.

Portion of a skeleton, obtained at Risdon in 1918 and purchased for the Museum, consisting of Cranium. Mandible. Sternum (incomplete) in two fragments. Ribs, ten (incomplete). Scapula, L. acronium process. Scapula, R. coracoid process. Scapula, L. coracoid process. Vertebræ, fourteen (incomplete). Humerus, R., head and proximal end of shaft only. Humerus, L., ditto. Radius, L. (complete). Radius, R., distal portion. Ulna, R. (incomplete). Sacrum (six sacral vertebræ). Innominate, R. and L. (incomplete). Femur, R. and L. (incomplete). Fibula, R., distal extremity. Os calcis, R. and L. Astragalus, R. and L. Tarsal and Metatarsal bones.

T.M. No. A. 551. Cranium. Purchased 1919. (5).

T.M. No. A. 552. Cranium. Purchased 1919. (5).

T.M. No. A. (E.H.) 555. (6). Cranium (incomplete).
Obtained from Eaglehawk Neck. (7).

(4.) Maetsuycker Island is situated on the S.W. Coast. It was discovered by Tasman in 1642 and named after Joan Maetsuycker, a member of the Council of India.

That the natives used to visit the islands off the coast is well known. As regards the aborigines visiting Maetsuycker Island, see Flinders, "Voyage Terra Australis," Intro., p. clxxx.

(5.) Nos. A551 and A552 were purchased from Miss Betts. These skulls were for many years in the possession of the late J. R. Betts and were given to him by Mr. Howells, an old settler in the Bothwell district

(6.) The whole of the Eaglehawk Neck Collection (Nos. A. (E.H.) 555-886) is marked (E.H.)

(7.) Mr. T. I. Brister was responsible for the Museum obtaining this collection. For particulars concerning the discovery of these aboriginal remains see Lord, Pap. and Proc. Roy. Soc. Tas., 1918, p 118.

T.M. No. A. (E.H.) 556. Cranium (incomplete).
Obtained from Eaglehawk Neck.

T.M. No. A. (E.H.) 557. Cranium (incomplete).
Obtained from Eaglehawk Neck.

T.M. No. A. (E.H.) 558. Cranium (incomplete).
Obtained from Eaglehawk Neck.

T.M. No. A. (E.H.) 559. Cranium (incomplete).
Obtained from Eaglehawk Neck.

T.M. No. A. (E.H.) 560. Incomplete frontal, parietal and occipital bones of immature cranium.
Obtained from Eaglehawk Neck.

T.M. No. A. (E.H.) 561. Incomplete frontal, R. and L. parietal and L. temporal bones of cranium.
Obtained from Eaglehawk Neck.

T.M. No. A. (E.H.) 562. Incomplete frontal, portions of R. and L. parietal and occipital bones of cranium.
Obtained from Eaglehawk Neck.

T.M. No. A. (E.H.) 563. Portions of R. and L. parietal and occipital bones of cranium.
Obtained from Eaglehawk Neck.

T.M. No. A. (E.H.) 564. Portion of frontal, R. temporal, occipital and parietal bones of a child.
Obtained from Eaglehawk Neck.

T.M. No. A. (E.H.) 565. Portions of occipital and parietal bones, R. and L. temporal (incomplete) of immature cranium.
Obtained from Eaglehawk Neck.

T.M. No. A. (E.H.) 566a. Portions of occipital and parietal bones of immature cranium.
Obtained from Eaglehawk Neck.

T.M. No. A. (E.H.) 566b. Portion of frontal bone of a child.
Obtained from Eaglehawk Neck.

T.M. No. A. (E.H.) 567. Temporal, R. Adult (incomplete).

T.M. No. A. (E.H.) 568. Temporal, R. Immature (incomplete).

T.M. No. A. (E.H.) 569. Temporal, R. Adult (incomplete).

T.M. No. A. (E.H.) 570. Temporal, L. Immature (incomplete).

T.M. No. A. (E.H.) 571. Temporal, R. Adult (incomplete).

T.M. No. A. (E.H.) 572. Temporal, L. Adult (incomplete).

T.M. No. A. (E.H.) 573. Temporal, L. Adult (incomplete).

T.M. No. A. (E.H.) 574. Temporal, R. Immature (incomplete).

T.M. No. A. (E.H.) 575. Temporal, R. Adult (incomplete).

T.M. No. A. (E.H.) 576. Temporal (incomplete).

T.M. No. A. (E.H.) 577. Mandible (complete).

T.M. No. A. (E.H.) 578. Superior maxillæ. Immature.

T.M. No. A. (E.H.) 579. Mandible. Immature (incomplete).

T.M. No. A. (E.H.) 580. Mandible, R. Ramus and body.

T.M. No. A. (E.H.) 581. Mandible of child (incomplete).

T.M. Nos. A. (E.H.) 582-589. Eight fragments of mandible.

T.M. No. A. (E.H.) 590. Superior maxillæ, R. and L. Adult.

T.M. No. A. (E.H.) 591. Fragment of superior maxilla. Adult.

T.M. No. A. (E.H.) 592. Fragment of superior maxilla. Immature.

T.M. No. A. (E.H.) 593. Fragment of superior maxilla. Adult.

T.M. No. A. (E.H.) 600. Clavicle, R. Portion of acromial extremity wanting.

T.M. No. A. (E.H.) 601. Clavicle, R. Portion of acromial extremity wanting.

T.M. No. A. (E.H.) 602. Clavicle, R. Adult (complete).

T.M. No. A. (E.H.) 603. Clavicle, L. Part of both extremities wanting.

T.M. No. A. (E.H.) 604. Clavicle, R. Portion of acromial end.

T.M. No. A. (E.H.) 605. Clavicle, L. Acromial extremity only.

T.M. No. A. (E.H.) 606. Clavicle, L. Sternal extremity only.

T.M. No. A. (E.H.) 607. Clavicle, L. Sternal extremity only.

T.M. No. A. (E.H.) 608. Clavicle, L. Portion of shaft, less extremities.

T.M. No. A. (E.H.) 609. Clavicle, L. Acromial extremity.

T.M. No. A. (E.H.) 610. Clavicle, R. Immature.

T.M. No. A. (E.H.) 611. Clavicle, L. Immature. Less acromial extremity.

T.M. No. A. (E.H.) 612. Clavicle, R. Immature. Less portion of shaft.

T.M. No. A. (E.H.) 613. Clavicle. Immature. Part of shaft.

T.M. No. A. (E.H.) 614. Scapula, L. (incomplete).

T.M. No. A. (E.H.) 615. Scapula, L. (incomplete).

T.M. No. A. (E.H.) 616. Scapula, L. (incomplete).

T.M. No. A. (E.H.) 617. Scapula, L. Immature (incomplete).

T.M. No. A. (E.H.) 618. Scapula, L. Immature (incomplete).

T.M. No. A. (E.H.) 619. Scapula, R. (incomplete).

T.M. No. A. (E.H.) 620. Scapula, R. (incomplete).

T.M. No. A. (E.H.) 621. Scapula, R. Glenoid cavity and coracoid process.

T.M. No. A. (E.H.) 622. Scapula, L. Immature (incomplete).

T.M. No. A. (E.H.) 623. Scapula, L. (incomplete).

T.M. No. A. (E.H.) 624. Scapula, R. (incomplete).

T.M. No. A. (E.H.) 625. Scapula, R. Immature (incomplete).

T.M. No. A. (E.H.) 625. Scapula, R. Immature (incomplete).

T.M. No. A. (E.H.) 626. Scapula, L. Immature (incomplete).

T.M. No. A. (E.H.) 627. Scapula, L. (incomplete).

T.M. No. A. (E.H.) 628. Scapula, L. (incomplete).

T.M. No. A. (E.H.) 629. Scapula, L. Acromial process.

T.M. No. A. (E.H.) 630. Humerus, R. Shaft and distal extremity.

T.M. No. A. (E.H.) 631. Humerus, L. Shaft.

T.M. No. A. (E.H.) 632. Humerus, R. Shaft and distal extremity.

T.M. No. A. (E.H.) 633. Humerus, L. Less both extremities.

T.M. No. A. (E.H.) 634. Humerus, R. Shaft, less both extremities.

T.M. No. A. (E.H.) 635. Humerus, L. Shaft (child).

T.M. No. A. (E.H.) 636. Humerus, L. Distal extremity (child).

T.M. No. A. (E.H.) 637. Humerus, L. Distal extremity.

T.M. No. A. (E.H.) 638. Humerus, R. Part of shaft and distal extremity.

T.M. No. A. (E.H.) 640. Humerus, R. Distal extremity.

T.M. No. A. (E.H.) 641. Humerus, L. Distal extremity (child).

T.M. No. A. (E.H.) 642. Humerus, R. Distal extremity.

T.M. No. A. (E.H.) 643. Humerus, L. Part of shaft and distal extremity.

T.M. No. A. (E.H.) 644. Humerus, R. Part of shaft (child).

T.M. No. A. (E.H.) 645. Humerus, R. Part of shaft (child).

T.M. No. A. (E.H.) 646. Humerus, L. Part of shaft and distal extremity.

T.M. No. A. (E.H.) 647. Humerus, R. Comparatively complete (young child).

T.M. No. A. (E.H.) 648. Humerus, L. Complete in three parts (adult).

T.M. No. A. (E.H.) 649. Humerus, L. Distal extremity.

T.M. No. A. (E.H.) 650. Humerus, L. (Child.)

T.M. No. A. (E.H.) 651. Humerus, L. Distal extremity.

T.M No. A. (E.H.) 652. Humerus, R. Proximal extremity.

T.M. No. A. (E.H.) 653. Humerus, R. Proximal extremity.

T.M. No. A. (E.H.) 654. Humerus, L. Proximal extremity.

T.M. No. A. (E.H.) 655. Humerus, L. Shaft.

T.M. No. A. (E.H.) 656. Humerus, R. Distal extremity.

T.M. No. A. (E.H.) 657. Humerus. Portion of shaft.

T.M. No. A. (E.H.) 658a. Humerus, L. Portion of shaft (immature).

T.M. No. A. (E.H.) 658b. Humerus, L. Portion of head.

T.M. No. A. (E.H.) 659a. Humerus. Portion of head.

T.M. No. A. (E.H.) 659b. Humerus. Part of shaft.

T.M. No. A. (E.H.) 660. Ulna, R. Proximal extremity and portion of shaft.

T.M. No. A. (E.H.) 661. Ulna, L. Proximal extremity and portion of shaft.

T.M. No. A. (E.H.) 662. Ulna, R. Proximal extremity and portion of shaft.

T.M. No. A. (E.H.) 663. Ulna, L. Shaft, less head.

T.M. No. A. (E.H.) 664. Ulna, R. Proximal extremity and shaft.

T.M. No. A. (E.H.) 665. Ulna, L. Less head and styloid process.

T.M. No. A. (E.H.) 666. Ulna, L. Proximal extremity.

T.M. No. A. (E.H.) 667. Ulna, R. Proximal extremity.

T.M. No. A. (E.H.) 668. Ulna, L. Proximal extremity and part of shaft.

T.M. No. A. (E.H.) 669. Ulna, R. Proximal extremity and portion of shaft.

T.M. No. A. (E.H.) 670. Ulna, R. Proximal extremity and part of shaft.

T.M. No. A. (E.H.) 671. Ulna, L. Proximal extremity and part of shaft

T.M. No. A. (E.H.) 672. Ulna, L. Proximal extremity and part of shaft.

T.M. No. A. (E.H.) 673. Ulna, L. Proximal extremity and part of shaft.

T.M. No. A. (E.H.) 674. Ulna, L. Head and part of shaft.

T.M. No. A. (E.H.) 675. Ulna, L. Head and part of shaft.

T.M. No. A. (E.H.) 676. Ulna, L. Portion of head and shaft.

T.M. No. A. (E.H.) 677a. Ulna, L. Portion of head and shaft.

T.M. No. A. (E.H.) 677b. Ulna, L. Head.

T.M. No. A. (E.H.) 677c. Ulna, R. Head.

T.M. No. A. (E.H.) 678. Radius, R.

T.M. No. A. (E.H.) 679. Radius, R. Less distal extremity.

T.M. No. A. (E.H.) 680. Radius, R. Distal extremity.

T.M. No. A. (E.H.) 681. Radius, L. Distal extremity.

T.M. No. A. (E.H.) 682. Radius, R. Distal extremity.

T.M. No. A. (E.H.) 683. Radius, L. Distal extremity.

T.M. No. A. (E.H.) 684. Radius, R. Complete in two parts.

T.M. No. A. (E.H.) 685. Radius, R. Shaft, less both extremities.

T.M. No. A. (E.H.) 686. Radius, L. Shaft, less both extremities.

T.M. No. A. (E.H.) 687. Radius, L. Distal extremity.

T.M. No. A. (E.H.) 688. Radius, L. Head and part of shaft.

T.M. No. A. (E.H.) 689. Radius, R. Head and part of shaft.

T.M. No. A. (E.H.) 690. Radius, R. Head and part of shaft (immature).

T.M. No. A. (E.H.) 691a. Ulna, R. Shaft.

T.M. No. A. (E.H.) 691b. Ulna. Portion of shaft.

T.M. No. A. (E.H.) 692. Sternum. Presternum and mesosternum less ensiform process.

T.M. No. A. (E.H.) 693. Sternum. Portion of mesosternum.

T.M. No. A. (E.H.) 694. Sacrum. Less part fifth sacral vertebræ. Laterally distorted.

T.M. No. A. (E.H.) 695. Sacrum. First and second sacral vertebræ.

T.M. No. A. (E.H.) 696. Sacrum. Adult. Practically complete.

T.M. No. A. (E.H.) 697. First sacral vertebra (immature).

T.M. No. A. (E.H.) 698. First sacral vertebra (immature).

T.M. No. A. (E.H.) 699. Sacral vertebræ (immature).

T.M. No. A. (E.H.) 700. Sacral vertebræ (immature).

T.M. No. A. (E.H.) 701. Os innominatum, L. Ilium. Adult (incomplete).

T.M. No. A. (E.H.) 702. Os innominatum, L. Ilium. Adult (incomplete).

T.M. No. A. (E.H.) 703. Os innominatum, L. Ilium. Adult (incomplete).

T.M. No. A. (E.H.) 704. Os innominatum, R. Ilium. Adult (incomplete).

T.M. No. A. (E.H.) 705. Os innominatum, L. Ilium. Adult (incomplete).

T.M. No. A. (E.H.) 706. Os innominatum, R. Ilium. Adult (incomplete).

T.M. No. A. (E.H.) 707. Os innominatum, R. Ischium. Adult (incomplete).

T.M. No. A. (E.H.) 708. Os innominatum, R. Ilium. Adult (incomplete).

T.M. No. A. (E.H.) 709. Os innominatum, L. Ilium. Adult (incomplete).

T.M. No. A. (E.H.) 710. Os innominatum, L. Ischium. Adult (incomplete).

T.M. No. A. (E.H.) 711. Os innominatum, R. Ischium. Adult (incomplete).

T.M. No. A. (E.H.) 712. Os innominatum, L. Ischium. Adult (incomplete).

T.M. No. A. (E.H.) 713. Os innominatum, R. Ischium. Adult (incomplete).

T.M. No. A. (E.H.) 714. Os innominatum, L. Ischium. Adult (incomplete).

T.M. No. A. (E.H.) 715. Os innominatum, L. Ischium. Adult (incomplete).

T.M. No. A. (E.H.) 716. Os innominatum, L. Pubis. Adult (incomplete).

T.M. No. A. (E.H.) 717. Os innominatum, L. Ilium. Adult (incomplete).

T.M. No. A. (E.H.) 718. Os innominatum, R. Ilium. Immature.

T.M. No. A. (E.H.) 719. Os innominatum, L. Ilium. Immature.

T.M. No. A. (E.H.) 720. Os innominatum, L. Ilium. Immature.

T.M. No. A. (E.H.) 721. Os innominatum, L. Ilium. Immature.

T.M. No. A. (E.H.) 722. Os innominatum, L. Ilium. Immature.

T.M. No. A. (E.H.) 723. Os innominatum, R. Ilium. Immature.

T.M. No. A. (E.H.) 724. Os innominatum, R. Ilium. Immature.

T.M. No. A. (E.H.) 725. Os innominatum, L. Ilium. Immature.

T.M. No. A. (E.H.) 726. Os innominatum, R. Ilium. Immature.

T.M. No. A. (E.H.) 727. Os innominatum, R. Ilium. Immature.

T.M. No. A. (E.H.) 728. Os innominatum, R. Ilium Immature.

T.M. No. A. (E.H.) 729. Os innominatum, L. Ilium.

T.M. No. A. (E.H.) 730. Os innominatum, L. Ischium. Immature.

T.M. No. A. (E.H.) 731. Os innominatum, R. Pubis. Adult.

T.M. No. A. (E.H.) 732. Os innominatum, R. Ischium. Immature.

T.M. No. A. (E.H.) 733. Os innominatum, R. Ischium. Immature.

T.M. No. A. (E.H.) 734 Os innominatum, L. Pubis. Adult.

T.M. No. A. (E.H.) 735. Os innominatum, L. Ischium. Immature.

T.M. No. A. (E.H.) 736. Os innominatum, R. Ischium. Immature.

T.M. No. A. (E.H.) 737. Os innominatum, L. Ischium. Mature.

T.M. No. A. (E.H.) 738. Os innominatum, L. Pubis. Adult.

T.M. No. A. (E.H.) 739. Os innominatum, L. Pubis. Adult.

T.M. No. A. (E.H.) 740. Os innominatum, L. Pubis. Immature.

T.M. No. A. (E.H.) 741. Os innominatum, L. Ischium. Immature.

T.M. No. A. (E.H.) 742. Os innominatum, L. Pubis. Immature.

T.M. No. A. (E.H.) 743. Os innominatum, R. Ilium. Immature.

T.M. No. A. (E.H.) 744. Os innominatum, R. Ischium. Immature.

T.M. No. A. (E.H.) 745. Os innominatum, R. Ischium and Pubis. Immature.

T.M. No. A. (E.H.) 746. Os innominatum, R. Ischium and Pubis. Immature.

T.M. No. A. (E.H.) 747. Os innominatum, R. Ischium and Pubis. Immature.

T.M. No. A. (E.H.) 748. Os innominatum. Ischium and Pubis. Immature.

T.M. No. A. (E.H.) 749. Os innominatum. Ischium and Pubis. Immature.

T.M. No. A. (E.H.) 750. Os innominatum, L. Ischium and Pubis. Immature.

T.M. No. A. (E.H.) 751. Os innominatum. R. Ischium and Pubis. Immature.

T.M. No. A. (E.H.) 752. Os innominatum, R. Ischium. Immature.

T.M. No. A. (E.H.) 753. Os innominatum, R. Ischium. Immature.

T.M. No. A. (E.H.) 754. Os innominatum, L. Ischium. Immature.

T.M. No. A. (E.H.) 755. Os innominatum, R. Ischium. Immature.

T.M. No. A. (E.H.) 756. Femur, R. Adult.

T.M. No. A. (E.H.) 757. Femur, R. Adult.

T.M. No. A. (E.H.) 758. Femur, R. Adult.

T.M. No. A. (E.H.) 759. Femur, R. Adult.

T.M. No. A. (E.H.) 760. Femur, R. Immature.

T.M. No. A. (E.H.) 761. Femur, L. Adult.

T.M. No. A. (E.H.) 762. Femur, L. Adult.

T.M. No. A. (E.H.) 763. Femur, L. Adult.

T.M. No. A. (E.H.) 764. Femur, L. Adult.

T.M. No. A. (E.H.) 765. Femur, L. Distal extremity.

T.M. No. A. (E.H.) 766. Femur, L. Adult (in two portions).

T.M. No. A. (E.H.) 767. Femur, L. Shaft less epiphyses.

T.M. No. A. (E.H.) 768. Femur, L. Shaft.

T.M. No. A. (E.H.) 769. Femur, L. Shaft.

T.M. No. A. (E.H.) 770. Femur, R. Portion of shaft.

T.M. No. A. (E.H.) 771. Femur, L. Portion of shaft. Immature.

T.M. No. A. (E.H.) 772. Femur, R. Portion of shaft. Immature.

T.M. No. A. (E.H.) 773. Femur, R. Portion of shaft. Immature.

T.M. No. A. (E.H.) 774. Femur, R. Portion of shaft. Immature.

T.M. No. A. (E.H.) 775. Femur, L. Shaft.

T.M. No. A. (E.H.) 776. Femur, L. Distal extremity, less epiphyses.

T.M. No. A. (E.H.) 777. Femur, L. Distal extremity, less epiphyses.

T.M. No. A. (E.H.) 778. Femur, L. Distal extremity, less epiphyses.

T.M. No. A. (E.H.) 779. Femur, L. Distal extremity, less epiphyses.

T.M. No. A. (E.H.) 780. Femur, L. Distal extremity, less epiphyses.

T.M. No. A. (E.H.) 781. Femur. Distal epiphysis.

T.M. No. A. (E.H.) 782. Femur. Distal epiphysis.

T.M. No. A. (E.H.) 783. Femur. Distal epiphysis.

T.M. No. A. (E.H.) 784. Femur. Distal epiphysis.

T.M. No. A. (E.H.) 785. Femur. Distal epiphysis.

T.M. No. A. (E.H.) 786. Femur. Distal epiphysis.

T.M. No. A. (E.H.) 787. Femur. Distal epiphysis.

T.M. No. A. (E.H.) 788. Femur. Distal epiphysis.

T.M. No. A. (E.H.) 789. Femur. Distal epiphysis.

T.M. No. A. (E.H.) 790. Femur. Distal epiphysis.

T.M. No. A. (E.H.) 791. Patella. Adult.

T.M. No. A. (E.H.) 792. Patella. Adult.

T.M. No. A. (E.H.) 793. Tibia, L. Adult.

T.M. No. A. (E.H.) 794. Tibia, R. Adult.

T.M. No. A. (E.H.) 795. Tibia, R. Adult.

T.M. No. A. (E.H.) 796. Tibia, R. Adult.

T.M. No. A. (E.H.) 797. Tibia, L. Adult.

T.M. No. A. (E.H.) 798. Tibia, L. Adult.

T.M. No. A. (E.H.) 799. Tibia, R. Distal extremity. Adult.

T.M. No. A. (E.H.) 800. Tibia. Head. Adult.

T.M. No. A. (E.H.) 801. Tibia. Portion of shaft.

T.M. No. A. (E.H.) 802. Tibia. Proximal extremity and shaft.

T.M. No. A. (E.H.) 803. Tibia, L. Less epiphyses.

T.M. No. A. (E.H.) 804. Tibia, L. Less epiphyses.

T.M. No. A. (E.H.) 805. Tibia. Shaft.

T.M. No. A. (E.H.) 806. Tibia, R. Shaft.

T.M. No. A. (E.H.) 807. Tibia, L. Shaft.

T.M. No. A. (E.H.) 808. Tibia, L. Shaft.

T.M. No. A. (E.H.) 809. Tibia, R. Shaft and proximal extremity, less superior epiphysis.

T.M. No. A. (E.H.) 810. Tibia, R. Proximal extremity (immature).

T.M. No. A. (E.H.) 811. Tibia, R. Proximal extremity (immature).

T.M. No. A. (E.H.) 812. Tibia. Part of shaft and distal extremity, less epiphysis.

T.M. No. A. (E.H.) 813. Tibia, R. Shaft, less superior epiphysis.

T.M. No. A. (E.H.) 814. Tibia. Superior epiphysis.

T.M. No. A. (E.H.) 815. Tibia. Superior epiphysis.

T.M. No. A. (E.H.) 816. Tibia. Superior epiphysis.

T.M. No. A. (E.H.) 817. Tibia. Superior epiphysis.

T.M. No. A. (E.H.) 818. Tibia. Superior epiphysis.

T.M. No. A. (E.H.) 819. Tibia. Superior epiphysis.

T.M. No. A. (E.H.) 820. Tibia. Superior epiphysis.

T.M. No. A. (E.H.) 821. Fibula, R. Head and shaft.

T.M. No. A. (E.H.) 822. Fibula, L. Head.

T.M. No. A. (E.H.) 823. Fibula, R. Head.

T.M. No. A. (E.H.) 824. Fibula, R. Distal extremity.

T.M. No. A. (E.H.) 825. Fibula, R. Distal extremity.

T.M. No. A. (E.H.) 826. Fibula, R. Distal extremity.

T.M. No. A. (E.H.) 827. Fibula. Distal extremity.

T.M. No. A. (E.H.) 828. Fibula. Distal extremity.

T.M. No. A. (E.H.) 829. Fibula. Distal extremity.

T.M. No. A. (E.H.) 830. Fibula, L. Head and proximal portion of shaft.

T.M. No. A. (E.H.) 831. Fibula. Portion of shaft.

T.M. No. A. (E.H.) 832. Fibula. Portion of shaft.

T.M. No. A. (E.H.) 833. Fibula. Portion of shaft.

T.M. No. A. (E.H.) 833. Fibula. Portion of shaft.

T.M. No. A. (E.H.) 834. Fibula. Portion of shaft.

T.M. No. A. (E.H.) 835. Fibula, L. Distal extremity.

T.M. No. A. (E.H.) 836. Fibula, L. Distal extremity.

T.M. No. A. (E.H.) 837. Fibula. Portion of shaft.

T.M. No. A. (E.H.) 838. Fibula. Portion of shaft.

T.M. No. A. (E.H.) 839. Femur. Superior epiphysis.

T.M. No. A. (E.H.) 840. Femur. Superior epiphysis.

T.M. No. A. (E.H.) 841. Femur. Superior epiphysis.

T.M. No. A. (E.H.) 842. Femur. Superior epiphysis.

T.M. No. A. (E.H.) 843. Femur. Superior epiphysis.

T.M. No. A. (E.H.) 844. Femur. Superior epiphysis

T.M. No. A. (E.H.) 845. Rib, L. First cervical.

T.M. No. A. (E.H.) 846. Rib, R. First cervical.

T.M. No. A. (E.H.) 847. Rib, R. First cervical (child).

T.M. No. A. (E.H.) 848. Rib, R. Portion of body.

T.M. No. A. (E.H.) 849. Rib, L. Portion of body.

T.M. No. A. (E.H.) 850. Rib. Fragment of body.

T.M. Nos. A. (E.H.) 851-871. Ribs. Fragments.

T.M. No. A. (E.H.) 872. Ribs. Fragments, 100 pieces.

T.M. No. A. (E.H.) 873. Metacarpal, metatarsal and phalangeal bones (87 bones).

T.M. No. A. (E.H.) 874. Carpal and tarsal bones.

T.M. No. A. (E.H.) 875. Atlas.

T.M. No. A. (E.H.) 876. Axis.

T.M. No. A. (E.H.) 877. Axis.

T.M. No. A. (E.H.) 878. Axis.

T.M. No. A. (E.H.) 879. Axis.

T.M. No. A. (E.H.) 880. Axis.

T.M. No. A. (E.H.) 881. Axis.

T.M. No. A. (E.H.) 882. Axis.

T.M. No. A. (E.H.) 883. Vertebræ. Cervical, dorsal, and lumbar. (Fifty vertebræ, fairly complete.)

T.M. No. A. (E.H.) 884. Vertebræ. Portions.

T.M. No. A. (E.H.) 885. Numerous small portions of bones.

T.M. No. A. (E.H.) 886. Malar bones (3), R., R. and L.

ADDITIONS TO THE FUNGUS FLORA OF TASMANIA.

Part 3.

By L. Rodway, C.M.G.,

Government Botanist.

(Read 11th October, 1920.)

The previous notes and additions to our cryptogamic flora may be found in the Papers and Proceedings for the years 1917 and 1919.

Of those plants here recorded for Tasmania, but not as new species, fuller descriptions may be found in Cooke's Australian Fungi or in Massee's British Fungus Flora.

Cordyceps hawkesii. This, though close to *C. gunnii*, appears to be fairly distinct. The club is paler in colour; the perithecia less sunk and the fertile portion ceases abruptly and not imperceptibly shading away.

It appears to be confined to the north-east of Tasmania.

Ascomyces aureus, Mag. This is the Golden Blister of Black and Lombardy Poplar, common in many places in Tasmania.

Introduced with the host plant.

Ascocorticium effusum, n.s. A thin crimson sheet growing over dead wood and adjoining earth for many centimetres; immarginate and undifferentiated into body and hymenium, asci arising direct from web-like hyphæ. Asci clavate, 8 spored. Spores elliptic, obtuse, smooth, hyaline, 12-15 x 6μ. Paraphyses filiform, septate, slightly thickened at apex.

On dead wood and clay. McRobie's Gully. Something like *Trentopolia* but more crimson, very different in structure. Evanescent.

Ascobolus nitidus, n.s. Discoid, 0.3 mm. diameter on a slender stem of the same length, pale dull greenish-ochre, waxy, smooth externally. Asci protruding, pyriform, 8 spored; spores in an irregular group, oblong, sooty-black, smooth, uniseptate, 10 x 6μ.

On rotting *Poria*. Cascades, Hobart.

Peziza badia, Pers. Sessile, concave, then flat, mostly 2-4cm. diameter, disk dark brown, external surface paler, often tinged with purple, minutely granular. Asci cylindric, 8 spored. Spores elliptic, hyaline, smooth, or minutely verrucose, 16 x 9 μ Paraphyses slender.

Very like *Curreyella trachycarpa,* but with very different spores.

Mt. Nelson.

Sepultaria austro-geaster, n.s. Oblong, at first subterranean and closed, about 1cm. diameter, at maturity bursting above just on surface of soil into few lobes as in outer peridium of *Geaster.* Fleshy, dull brown, rather darker internally; externally clothed with numerous hyphæ permeating sandy soil. Asci linear, 8 spored. Spores broadly elliptic, very obtuse, hyaline, smooth, 24 x 10 μ. Paraphyses clavate with a thickened end not coloured, septate, the cells in many instances swollen and moniliform.

On Sandy hill, Bellerive, Aug.-Sept.

Sepultaria aurantia, n.s The habit of the last only rather smaller. Margin fimbriate, disk bright orange-yellow to ochre. Spores elliptic, rather acute at both ends, hyaline, smooth, 22 x 8 μ. Paraphyses filiform, septate, hyaline.

On Sandy hill, Bellerive, Aug.-Sept.

Geopyxis pallidus, n.s. Cupshaped, 5-8mm. diameter, on a slender stem 10mm., all parts white, thin, fleshy, externally smooth or slightly mealy, margin brownish with short irregular fimbriations. Hymenium smooth, asci linear, spores uniseriate, oblong, 22-24 x 10 μ., hyaline, minutely verruculose. Paraphyses filiform.

On ground, Mt. Nelosn.

Cyathicula multicuspidata, n.s. Cupshaped, sessile, white, delicate, about 1mm. broad, smooth, but the margin armed with compound lobes. Asci cylindric, 8 spored, uniseriate. Spores hyaline, smooth, continuous, narrow oblong, 15-20 x 4 μ., but immature.

On decaying rhachis of *Dicksonia.*

Peziza brunneo-atra, Desm. Dark chestnut-brown, about 1cm., sessile, broadly attached, discoid at maturity. Asci cylindric. Spores uniseriate, elliptic, hyaline, granular rough, 27 x 12 μ. Paraphyses filiform with brown clavulate tips. *Humaria macrospora, Fckl.*

On ground, Bellerive.

Helotium claro-flavum, Berk. Small, seldom exceeding 1mm. diameter, lemon-yellow throughout, concave to convex, very shortly stalked. Asci clavate, spores elliptic, hyaline, obtuse, 7-10 x 3 μ.

On dead wood, not at all common.

Helotium striatum, n.s. Attached by a very short slender stalk or sessile; disk fleshy, soft, concave, pale cinereous when fresh, ochre when dry, 1-2mm. diameter, externally sooty brown, smooth, striate; asci clavate, paraphyses filiform; spores oblong, obtuse, hyaline 6 x 3μ.

On dead wood.

Helotium microsporium, n.s Discoid, shortly stipitate, 1-2mm. diameter, livid, nearly white, soft fleshy, externally smooth; asci cylindric, spores hyaline, smooth oblong, obtuse, 4.5 x 2 μ.

Very close to *Mollisia.*

Much paler than *H. prasinum.*

On dead wood.

Helotium carnosum, n.s. Sessile or very shortly stalked, pale ochre yellow when fresh, soft fleshy becoming darker to dull red when old, 1mm. diameter, rim thick involute, convex, externally delicately pruinose; asci cylindric; spores hyaline, smooth, narrow oblong, 6 x 1.5 μ.

On dead wood.

Helotium tasmanicum, n.s. Sessile, concave to convex, 2-4mm., bright orange yellow all over but externally a little paler, slightly furfuraceous, asci cylindric, spores narrow oblong, 14-18 x 3-4.5 μ., hyaline, smooth, not with a darker disk as in *H. citrinum*, to which it is closely related.

On dead wood.

Mollisia undulata, n.s. Soft waxy, sessile, usually broadly affixed, concavo-discoid, undulate, 5-8mm., livid gray, turning black when dry, externally black; asci narrow cylindric, spores narrow oblong, smooth hyaline, 6 x 1.5 μ., paraphyses filiform.

Differs from *M. cinerea* in large size, broad attachment, undulate disk, black exterior, and absence of even white margin, completely collapsing when dry.

On rotting wood.

Dasyscypha ovina, n.s. Superficial to partially erumpent, sessile, cupshaped, exciple exceeding the disk, externally coarsely woolly with a dense vestiture of globose cells, dull ochre brown, 1-2mm. diameter; asci cylindric, spores 8, uniseriate, broadly elliptic, obtuse, smooth, brown at maturity, 14 x 8 μ, paraphyses slender with clavate olive tips.

On dead bark.

Humaria omphalodes, Mass. Minute disks 1mm. diameter, orange to reddish, arising from a spreading subiculum on burnt ground; spores elliptic, 11-13 x 6 μ.

On Domain.

Cenangella tasmanica, n.s. Erumpent, cartilaginous, sessile, concavo-convex, smooth, black; asci cylindric, 8 spores in one series; spores elliptic, subacute, uniseptate, smooth, wall thick, light purple when mature 10-12 x 5 μ., paraphyses filiform, mostly branched above.

On dead wood.

Patellaria masseea, n.s. Gregarious, sessile, concave then plane, dark green becoming black when dry, 1-2 mm. broad. Asci clavate, base little constricted, 8 spored, staining blue with iodine, 150 x 10 μ. Spores in two series, oblongo-elliptic, 3-6, often 5, septate, hyaline, 18-22 x 5 μ. Paraphyses filiform, ramose, apex thickened

Allied to *P. tasmanica, Berk.*, but distinguished by the larger size of the ascophore, also by the larger septate spores. The hypothecium and excipulum consist of slender interwoven hyphæ.

On dead branches of *Acacia verniciflua.*

The above is the description of the plant by the late Mr. Massee in Kew Bulletin No. 138, under the name of *Patellaria maura, n.s.* Unfortunately this name was already applied by Phillips to a European plant.

Tremella mesenterica, Retz. Toughly gelatinous, lobes short and contorted, surface pruinose with white spores.

Very common, but not recorded for Tasmania. Much tougher and darker than in *T. lutescens.*

Auricularia mesenterica, Fries. Waxy when fresh, resupinate on under surface of fallen wood, nearly black to greyish-brown, margin reflexed, velvety.

Fairly common.

Coniophora ochracea, Mass. Very broadly effused, submembranaceous, usually indeterminate; hymenium pulverulent, whitish then ochraceous; spores yellowish, subglobose, 8 x 6 μ.

Common on dead wood.

Solenia anomala, Fries. Minute, cup-shaped, on a slender stalk usually under 1 mm. high, externally hairy dingy brown to ochraceous, hymenium smooth, spores oblong, 7 x 4 μ.

On dead wood. Resembling a brown *Dasyscypha*, but the hymenium is basidiosporous.

Typhula tasmanica, n.s. Very slender, filiform, arising from a peltate strigose base, white or pale ochre below; stipes 2 cm., fertile portion 1 cm., and very little enlarged. Spores white, smooth, broadly oblong, slightly unequal sided, 6 x 3-4 μ.

On dead Eucalypt leaf.

Hydnangium glabrum, n.s. Irregularly globose, red-brown, 1cm., no sterile base. Peridium very thin not differentiated, gleba pale red-brown to ochre, canals very numerous and tortuous. Spores spherical glabrous or with few very minute asperities, white, 7-10 μ.

Close to *Hymenogaster levisporus.*

Slopes of Mt. Wellington.

Gymnomyces solidus, n.s. Irregularly globose, white, 1cm. Peridium none, the tramal plates defining the sporiferous cavities protruding externally. Gleba dense white, canals .3 mm. diameter closely packed, full of spores. Spores white globose, coarsely echinulate, 12 μ.

Slopes of Mt. Wellington.

Hymenogaster barnardi, n.s. Irregularly globose, white, 1-1.5 cm. Peridium very thin. Gleba rather tough white, cells numerous much convoluted, no sterile base. Spores oblong, acute at both ends, hyaline, smooth, white, 16-18 x 7 μ.

McRobie's Gully.

Hymenogaster maideni, n.s. Globose, 2 cm. Peridium very thin, white or slightly ochraceous when exposed. Sterile base obsolete. Gleba white, canals numerous, small, contorted. Spores ovate to oblong, yellow brown, smooth, 10-12 x 6 μ.

McRobie's Gully.

Dasyscypha pteridophylla, n.s. Cupulate on a short slender stem, lemon-yellow throughout, about 0.3 mm. diameter, clothed externally with short slender hairs, asci cylindric, eight spores biseriate. Spores fusiform, acute, hyaline, 16 x 1.5 μ. Paraphyses filiform.

On stipe of Dicksonia, National Park.

Rhizina atra, n.s. Discoid, black, plane, undulate, bound down except on the margin by mycelial strands, externally pruinose, mostly 1 cm. diameter, rather tough. Asci cylindric, eight spored in one series. Spores broadly oblong, dark brown, coarsely verrucose, 22 x 12 μ. Paraphyses filiform, clavate at the apex, brown.

On ground, in woods, McRobie's Gully.

Humaria tenaccella, Phil. Cupulate, to discoid, sessile, dark umber brown, externally paler and furfuraceous, asci cylindric, spores elliptic, smooth, hyaline, 15 x 7 μ.; paraphyses filiform with clavate dark umber tips.

On ground, Ridgeway.

Humaria rutilans, Fr. Cupulate, 0.5-1 cm. diameter, pale crimson to orange, externally slightly pubescent, paler. Asci cylindric; spores elliptic, obtuse, hyaline, granular when mature 25 x 14 μ.

On burnt ground, McRobie's Gully.

Humaria mollispora, n.s. Hemispheric, sessile, fleshy, pinkish-hyaline, 1 mm. diameter, exciple smooth, parenchymatous, disk plane; asci cylindric, eight spored. Spores elliptico-fusiform, smooth, hyaline, rather irregular in form due to the spore wall being very thin, 18 x 5 μ. Paraphyses filiform with slightly clavate tips.

Near *H. omphalodes, Mass.*

Cascades, Hobart.

Barlaea verrucosa, n.s. Hemispheric to plane, sessile, crimson, fleshy, 1 mm. diameter, the exciple parenchymatous. Asci cylindric, eight spores in one series. Spores globose 20 μ. diameter covered with large hemispheric warts even when young, hyaline. Paraphyses slender, claverulate, crimson.

On ground, Cascades, Hobart.

Morchella tasmanica, J. Ramsbottom. This is a Morel often found in Tasmania, and hitherto referred to *M. esculenta, Linn.* It differs chiefly in the capitulum being more cylindric, and the spores larger. The species is described in the Journal of Ecology, Vol. VIII., No. 1, March, 1920, from material gathered in Tasmania by Miss Gibbs.

Trametes serpens, Fr. At first tubercular and erumpent on dead wood, then resupinate and spreading on the surface, margin determinate, pubescent, pores rounded or angular, unequal, obtuse, 1.3 mm. diameter; spores ovoid, hyaline, 14 x 6 μ. (Cooke).

Very like *Poria vaporaria*, but distinguished at once by the much larger pores.

Lindisfarne.

Radulum orbiculare, Fr. Orbicular pale or white, often many centimetres wide and confluent, glabrous, but covered with prominent cylindric-obtuse to hemispheric tubercles 2-3 mm. long, margin hyssoid. Spores cylindric-oblong slightly curved. 10 x 5 μ

On dead wood, Cascades, Hobart.

FIRST DISCOVERY OF PORT DAVEY AND MACQUARIE HARBOUR, BY JAMES KELLY.

[Note.—The MS. containing the following account is in the Society's Library at Hobart, and owing to its great historical interest the Council decided to publish same. The Manuscript is in Kelly's handwriting, and apparently was originally contained in two note books which have since been bound together as one. There is, in the Mitchell Library, Sydney, another account of this voyage. It is not in Kelly's handwriting, but is signed by him. The peculiar fact is that this second account commences the voyage on 16th December, 1815, and concludes with the completion of the journey on January 24th.

The following account was evidently written some time after the completion of the voyage. As far as a printed copy will permit it is reproduced here exactly as Captain Kelly wrote it.

James Kelly was born at Parramatta, N.S.W., on 24th December, 1791. His parents do not appear to have been in affluent circumstances. Although self-educated, James Kelly's natural ability soon showed itself, as he rose from cabin boy to commander. He later became the owner of several ships trading out of Hobart.

Captain Kelly was appointed Harbour Master for the River Derwent on 18th April, 1819, and for many years lived at North Bruny. He died on 20th April, 1859.—Ed.]

FIRST DISCOVERY OF PORT DAVEY AND MACQUARIE HARBOUR, BY JAMES KELLY.

on the 12th of December 1815 James Kelly Sailed from Hobart Town in a Small Sized open five oared Whale Boat to Examine the then Unknown West Coast of Van. D. Land accompanied by the following Named four Men as the Crew

John Griffiths a Native of the Colony
George Briggs Do.
William Jones Englishman
Thomas Toombs Do.

on the 13th we attempted to haul the Boat up on the South Side of Recherche" Bay but was prevented by a Large Body of Natives giving us a Tremenduous Volley of Stones and Spears" we Were obliged to Retreat to the North Side of the Bay and Haul up for the Night

on the Morning of the 14th Launched and proceeded Round the South Coast of Van D. Land, With a fresh Breze at South East at Sun Set the Same Evening Hauled up in a Small Sandy Bay to the Northward of the Largest of the De., Witts Isles Here we had a Freindly Reception from a Large Number of Natives—we made them a few presents of Some Sugar and Biscuit But the Disgusting" Sight of them Puling Virmin" by Handfulls from thair Heads and Beards and Eating them Which they Seemed to Enjoy" more than the Sugar and Biscuit, in fact it Seemed Like a Rejoicing at them Seeing thair New Visitors, but they did not Seem the Least Hostile as they Brought Down thair Women and Children to see us, Which Denotes friendship in these Savages, at Dusk they took thair Leave of us and pointed to a Small Rising Hill about a Mile Distant Signifying that they intended to Sleep there we thought it was only a Decoy" to put us off our Guard but we Kept a Good Watch During the Night in Case of an attact but we Saw no more of them."

at Day Light of the 15th We Launched and proceeded to the Westward towards the South West Cape about Noon we put into a Bay about Eight or Nine Miles to the Eastward of S W Cape which was Named New Harbour but on Sounding found it Verry Shoal and only fit for small Vessels although Looking well to the Eye after Geting inside we Remained in this Place only two or three Hours and then proceeded on to the Westward—at Sun Set Hauled up on a Small Low Island about four Miles Eatward of S W Cape Where we Remained the Night" this is a Good Boat Harbour being only seperated by a Boat Passage from the Main Land, with a Good Stream of fresh Water and Plenty of Wood

on the Morning of the 16th Launched and Steered to the Westward—at Noon Rounded the S W Cape Distant about a quarter of a Mile with a fair Wind at South East and Steered along the Shore to the North West in the Evening Hauled up on a Small Grassy Island for the Night about Seven Miles to the N W of the Cape this Island Nearly Joins the Main, seperated only by a Small Boat Passáge, and not a good Boat Harbour

at Daylight of the 17th Launched and Steered along Shore to the North West at Noon Entered a Large inlet

Which was Named Port Davey" in Honor of the then (1) Lieutenant governor (2) of Van D. Land in the Evening we Hauled up on a Low Sandy point three Miles up the North Side of the Harbour Where we Remaind the Night, inside of a thick Scrub we Cleared away about two Rods" of Rich Ground and Sowed" a quantity of Garden Seeds" this was Named Garden Point in Consequence", We Remaind in the Harbour three Days the 18th. 19th & 20th Sounding and Making a Sketch of its Extent the Eastern arm was Named Bathurst" Harbour in Honor of Lord Bathurst" Secretary for the Colonies" the Inner West Point of Port Davey was Named Point Lucy" in Honor of Miss Davey' Daughter of the Lieutenant Governor. During our Stay in this place we Caught a Great quantity of Wild fowl" Black Swans Ducks teel and plenty of Ells and fish

on the 21st of December we took our Departure with a Light breze at East from Port Davy" and Steered along the Coast to the Northward in the Evening we Landed on a Low Grassy Island about five Miles to the Southward of Low Rocky point and Close to the Main Land, here we fell in with two Natives aboriginees, they Seemed Verry Much alarmed at Seeing us they Were above Six feet high thair Stomachs Verry Large Legs and arms Verry thin and Seemed as if they Were Nearly Starved we gave them two Black Swans of Which we had a good Stock in the Boat they Seemed Delighted with the present on Landing on the Island we intended to Remain the Night but fearing there Were More of them on the Island it was thought best to Leave it Which we Did and hauled up for the Night in a Small Creek half a Mile to the Southard of Low Rocky Point this was named Craw fish Creek in Consequence of the Immence Number of Craw fish that Lay at the Waters Edge they appeared to have been Gathered the day previous Which must have been Done by the Natives there Was above three tons in one Heap

on the Morning of the 22d Launched and Steered along the Land to the Northward at Sun Set Hauled up in a Snug Cove Near High Rocky point on the 23d and 24th a heavy Swell Roleing in from the Westward Which prevented us from proceeding along the Coast, 25th December Christmas Day"—Strong Gales" from the West-

(1.) [Note the wording, "of the *then* Lieutenant Governor." This is one of the indications that this account was written some time after the voyage. Colonel Davey was Lieutenant Governor of V.D.L. from 4th February, 1813, until April, 1817.—Ed.]

(2.) [Lieutenant Governor. V.D.L. was then a dependency of N.S.W. It was not proclaimed a separate colony until 3rd December, 1825.—Ed.]

ward and a Heavy Sea Heaving into the Cove, this Day we Had a Glorious" Feed for Dinner Two Black Swans" One Roasted (stuck up) the other a Sea Pie a three Decker in the Large Iron Pot a first Rate Christmas" Dinner on the West Coast of, Van Diemans Land—after Dinner" We Named the Cove Christmas Cove" by throwing" a Glass of Brandy into the Salt Water and Three Hearty Cheers for the ocasione—on the 26th the Gale abated—on the 27th in the Morning we Launched with a Light Breze" from the Southard and proceeded along Shore to the Northward In the fore Noon the Wind freshened and Blew Strong at S.S.Et. we Run Close along Shore untill the Evening Where we Hauled up on a Small Sandy Beach, inside of Some High Rocks that Lies a Little Distance from the Shore and about Six Miles to the Southard of Macquaric" Harbour—at Noon this day Passed Point Hibbs" Close too and Examined it—on the Morning of the 28th Launched Weather Calm Pulled along Shore to the Northward—at Noon Rounded a projecting point Which opened to an Inlet" to the South East, we found a Strong Current" Running out Which Made us Believe there must be a Large River in the South East Direction—"

The Whole face of the Coast Was, on fire and Lucky it Was for us it Was on fire, for the Smoke was so thick We Could not See a Hundred yards a Head of the Boat, on puling into the "Narrows" at the Small Entrance Island We Heard a Large Number of Natives Shouting and Making a Great Noise as if they Were Hunting Kangaroos,"

It was Lucky the Smoke was So thick for Had the Natives Seen the Boat passing through the Narrow Entrance it is possible they would have Killed Every person on Board by Volleys" of Stones and Spears" in thair usual Way

in the afternoon the Smoke Cleared off a little we found ourselves in a Large Sheet of Water Near a Small Island Where we Landed and found plenty of Black Swans on thair Nests, and plenty of thair Eggs' we Remaind on the Island, the Night Which Kept us Safe from the Natives—on the 29th the Morning was Clear we Could see Nearly all over the Harbour this Island Was Named Elizabeth Island in honor of Mrs. Gordon" Wife of James Gordon" Eq. of Pit Water" in Van D. Land, the Harbour was Named Macquariie" Harbour in Honor of the then Governor of New South Wales"—we Launched and pulled to a point on the South Shore Nearly oposite the Island Where we Caught about a Dozen fat Black Swans" to Eat we Had four of our Stock Left that we

Brought from Port Davey" after Catching a fresh Supply we gave those four thair Liberty in Macquarie" Harbour and Named the Point—Liberty Point in Consequence—at Sun Set We Hauled up on an Island about twenty five Miles up the Harbour which was Named Sarah' Island in Honor of Mrs. Birch" Wife of Thos. William Birch Eq. of Hobart Town

on the Morning" of the 30th Launched and proceeded further up the Harbour untill we Came to the Mouth of a fresh Water River Made a Sketch of it and Named it Gordon" River in Honor of James Gordon Esq. of Pit Water, he Having Kindly Lent his Boat for this particular trip of Discovery" Round Van D. Land

This Day we proceeded up an Inlet to the Southard of Gordon" River Which was Named Birches Inlet in Honor of Mr. Birch—on the 31st we Went Round Macquarie" Harbour Made a Sketch of it and found it to be a Bar Harbour only for Vessels of a Light Draft of Water we also found Plenty of Huon" pine Growing on the Banks of the Harbour

on the Morning of 1st January 1816 We Left Macquaric Harbour With a fresh Breze at South East This day we Run a Long Distance to the North West Having a Strong fair Wind at 8 P M attemped to get into a River Which was Named Retreat" River being Nearly Lost on the Bar in a Heavy Surf During the Night of the 1t January it Blew a Strong Gale from the Southard We were obliged to Heave the Boat Too by a Raft made of the oars with about forty five fathoms of Rope Where she Lay Verry Snug During the Night, the Men taking it in turns to attend to the Steer oar" to Keep the Boat End on to the Sea and Having a Good Tarpaulin" that Covered the Boat all over She Lay Verry Dry—at Day Light of the Morning of the 2d of January Hauled the Raft in, Set the Reefed Lug" and Steered in for the West point of Van D. Land with a Heavy Sea Runing," as we Neared the Shore we had to pass" through Heavy tide Rips the tide Runing to the Southard against the Wind made it more Dangerous"

We got Within 500 yards of the Shore, the Boat was pooped by a Heavy Sea that filled her to the thoughts—and had it Not Been for the Precaution" taken Before we Left Hobarton" that was of Having three good Buckets Slung with Lanyards and fastened to the thoughts for the purpose of Bailing the Boat on Such an Emergency" we must all Have Been Lost" However by the quick use of the Buckets the Boat was Soon Bailed out—we got under the Lee of the point and Landed on a Small Sandy Beach

Hauled the Boat up and Began to Examine" our Clothes Blankets Provisions and arms' all of Which" was Wet" and Nearly useless" fortunately the Amunition" was in a Small Box in the Stern of the Boat that was Water tight Which Preserved" it otherwise" we Should have been Badly off

We now thought we were Safe so far and had just got a Large fire" made to Dry ourselves" When to our great Astonishment" we were acosted by Six Huge Men, Black Natives" Each of them above Six feet high and Verry Stout Made thair faces Greased and Blacked they had a Spear in Each of thair Right Hands and two in thair Left" they Were quite Naked and appeard quite Ready for War" or Mischief—our Men got Greatly alarmed and Called out What Was to be Done—it was thought Best to make gestures" to them to Come Closeer to us" they Were Standing Behind a Low thick Scrub and did not seem inclined to Come any Nearer, our arms" all Wet and no Means of Defending ourselves we Were in a Verry Dangerous" Situation —

it hapened that Luck was Still at our side we Had 9 or 10 Black Swans" and a Large Wombat in the Boat that we Brought from Macquarie" Harbour for fresh Provisions" on Showing them one of the Swans" they Seemed Delighted and Came Nearer to the Boat after they Came out of the Scrub" we saw more of thair War Impliments" as Each of them Had a Spear betwen the Great toe of Each of thair feet Draging them along the Ground we Supposed they Had never Seen a White Man Before, it was thought best to try to Barter with them for thair Spears" that if we got Posssion" of them they Could not Hurt us —we Luckily Succeeded—and gave them four Swans" and the Wombat" for all thair Spear's they Seemed much pleased with thair Bargain" they Went away Holding up one Hand as a Sign of frienship we Were Equally pleased When they Were gone we saw no more of them, During the Evening a Great Number of Smoaks ware made along the Coast Which we thought to be Signals" Betwen the Natives

We Remained on the Beach that Night and got our arms" dried and put in fireing order Keeping a Good Watch, in Case the Natives Should pay us another Visit— On Examining our Bread flour Tea Sugar etc we found it nearly all Spoiled Which Caused us to go on Short allowance"—

on the Morning of the 3d of January at Day Light we Launched and proceeded to the Northward towards Cape Grim" it was Nearly Calm" during the day with a

Heavy Swell from the Westward we had to pull" Nearly the Whole of the Day in the Evening Hauld up in a Small Nook about 9 Miles to the Southard of Cape Grim"—

on the Morning of the 4th Launched and Stood to the Northward with a Light Breze at South East—about Noon Rounded Cape Grim" we passed Between two Pinnical Rocks that Lies Near the Cape we Were Nearly filled in a tide Rip Going through but Luckily Escaped We pulled along Shore to the Eastward untill we Came to the South End of the Largest Hunters Island we Landed on a point oposite on the Main Land on a Large flat of Pebble Stones to Boil our Kittle" and take a Rest there was a Great many fires along the Shore we Kept the Boat afloat and the arms" Ready in Case of an attack by the Natives Tooms" and Jones" were Left to take Care of the Boat and Have the arms" in Readiness" we had Just got a fire Lighted When we Saw a Large Body of Natives at Least fifty in Number Standing at the Edge of the Bush about fifty yards from us they Were all armed with Spears" and Waddies We Immediately Brought the arms" from the Boat and put ourselves" in a State of Defence" Near the fire they Began to advance Slowly towards us We held up our Pieces" and made Signs to them not to Come any Closeer" they Held up thair Spears" in Return with Loud-Laughing and Jeering" at us as if they thought we Were afraid of them at Seeing them so formidable" We thought it best to Retreat to the Boat, When all of a Sudden they Laid Down thair Spears and Waddies in the Edge of the Bush and holding up Both thair Hands as if they did not mean any Mischief, at the Same time Making Signs to us to Lay Down our arms" Which we did To Satisfy them for if we had Retreated to the Boat quickly they Must Have Killed Every one, Before we Could Have got out of the Reach of thair Spears x —they then Began to Come to us one by one Holding up Both thair Hands to Show they had no Weapon" But we Kept a good Lookout that they had no Spears betwen thair toes as they had on a former occasion" but they had none"—there was 20) Twenty two Came to the fire (we Made Signs to them that no more Should Come") upon that being Understood two More Came from the Bush together one of them Seemed to be a Chief a Stout good Looking Man about Six feet High 30 years of age, the other an old Man about Six feet Seven Inches High with Scarcely" a Bit of flesh" on his Bones, When the Chief Came he ordered them all to sit Down on the Ground Which they did and formed a Sort of Circle" Round the fire, the Chief ordered the old Man to Dance and Sing, as if to amuse us Which he did, Making

ugly" faces and puting himself into Most Singular attitudes, While the old Man Was Engaged in his Dancing and Singing we found out it was only to take our attention off What the Chief and his Men Were Doing, he ordered them to gather pebble Stones about the Size of Hens Eggs and put them Betwen thair Legs Where they Sat for the purpose as we Supposed to make an atack on us with the Stones at this our Men Began to get alarmed and Expecting some Mischief Would be Done We planed it to give them a few Swans" and get off as Well as we Could—Briggs—Brought two Swans" from the Boat one under Each arm When the Chief Saw them he Rushed at Briggs to take the Swans" from him but did not Succeed he then ordered his men to give us a Volley" of Stones Which they did by him giving them the time in most Beautiful order by him Calling With the Swing of the arm three times Yah". yah". yah", and a Severe Volley it Was, I Had a pair of Large Dueling Pistols in my Coat pocket Loaded with two Balls Each and seeing there Was no, alternative" I fired one amongst them, Which Dispersed them the other I fired after them as they Ran away two of them Draged Briggs along the Ground a little Distance to get the Swans" from him but did not Succeed—the Chief and his men Run into the Bush and Was quickly" out of Sight—on Looking Round after they had all Ran" away we found the 6 feet 7 inch Dancing Gentleman Laying on his Back on the Ground We thought of Course he was Dead" but on turning him over to Examine his Wounds" found he had not a Blemish on him, his Pulse" was going at 130" it must have been the Report of the Pistols" that frightened him, We then set him on his feet to See if he Could Walk he opened his Eyes" and trembled Verry Much We Led him a few Steps towards the Bush he stood up Straight Looked around him and took one Jump towards the Bush the Next Leap" he was out of Sight as Soon as he was out of Sight the Hills around Echoed" with Shouts of Joy" from the Voices of Men Women" and Children that the Daning" Gentleman had escaped—We measured the first Jump the old Man took, it was Exactly Eleven" yards but the Second one must have been More this was More Like the Jump of a Kangaroo" than a Man—

We found Several Marks of Blood on the Stones in the Direction that the Natives Run away When the Pistols was fired, Some of them must have been Wounded, we got into our Boat, Just as we Were pulling away we Received a Volley" of Stones and Spears from the Natives one Spear Went through the Side of the Boat But Luck-

ily" no one was Hurt We Landed on a Small Rock Covered with Birds they Were Laying we got Six Buckets full of fresh Eggs" a good Supply"

this Seemed to ofend the Natives as a Number of Women Came down on a point of Rocks and abused" us Verry Much for taking thair Eggs" We pulled to a Small Island 3 Miles to the North East" one of the Hunters Islands Where we Hauled up for the Night

On the 5th at Daylight we Launched with a Light Breze at N.W. and Went into Robins" Passage"—Examined it, in the Evening Hauled up for the Night in the East End of the Passage—

on the 6th in the Morning" We Launched with a Light Breze" at South West and pulled along Shore towards Circular Head at Sun Set Hauled up for the Night on the Beach" at the South East side of the Head—on the 7th at Day Light Launched with a Strong Breze" from the Westward and Run along Shore all the Day to the Eastward at Sun Set Hauled up on a Pebbley" Beach about Forty Miles" from Circular Head—The 8th Strong Brezes from the Westward at Day Light Launched and Run along Shore to the Eastward, this Day" Run a Long Distance" at Sun Set arrived at What was Called the first Western" River—We hauld up for the Night this River has Since been Called Port Sorell"—(3)

9th at Daylight Launched Wind North West and Steered towards Port Dalrymple" at Noon arrivd at George" town, on Landing at the Wharf we Were Hailed by a Man Like a Soldier"—Who, are you What Boat is that Before we had time to answer" Eight Men Rushed from Bihind an old Building with Muskets' and fixed Bayonets' in thair Hands Sayaing if you Move we Will Kill Every Man of you, one of them Seemed to be an officer" he had a Double Barrel in his hand Himself and the Rest Were all Dressed in Kangaroo Skin and a Ruffian" Like Mob" they Were, the officer Said have you any arms" in the Boat, the answer Was yes" plenty, he then said Sargeant Handcuff them all and hand the arms" out of the Boat —we were Handcuffed two and two as we Came out of the Boat But the Captain of the Boat had the Honor of being Handcuffed by himself When we were out of the Boat Standing on the Wharf the officer Said now my Ladds" What Have you to Say for yourselves" I have been a Long time Looking for you and have got you at Last"—

(3.) [Note the wording:—This has *since* been called Port Sorell Colonel William Sorell held office as Lieutenant Governor from 8th April, 1817, until 1824. The designation was probably changed during his term of office.—Ed.]

you are the Collegues" of Michael" Howe the Bushranger and if you do not give me all the Information—Where we Can find Howe and his party I will send you all to Hobart Town in Double Irons I told him we Knew nothing of Howe" and that we Were on a Voyage of Discovery Round the West Coast of Van Diemans" Land he Laughed at this and Said that Story wont do for me I then Recognised" him to be Major Stuart 46th Reigment Comndant at Launceston—I put my hand into my Waistcoat Pocket to find the Key" of the Amunition" Box" Where our Port Clearance" Was Kept, he in a flurry" Said Sergeant" Mind he is puting his hand in his Pocket I Supposed the Gallant Major" thought I was going to take out a Pistol to shoot him the Serjeant Seized my hand and Said what are you going to do—I said there is the Key of the Box" that will give you all the Information you Require.

the Sargeant unlocked the Box and took out the amunition" the Journal" and Port Clearance" Which he handed to the Major it Was a printed form in the Usual" Way filled up and to the following" Effect—

Commandants Office

Military Barracks Hobart Town

Those are to Certify to all Whome it May Concern" that the Boat Elizabeth" Commanded by Mr. James Kelly" was Cleared out for the West Coast of Van Diemans Land on a Voyage of Discovery after Having paid the Acustomed Dues

Given under my hand
this 11th Day of December, 1815
in the absence" of the Lieutenant
Governor

Wm. Nairn,
Captain 46th Reigment
Commandant.

the Names of the following Persons" who Comprised the Crew of the Boat was Writen in the Margin" of the Clearance"

John . Griffiths
George . Briggs"
William Jones—
Thomas Tooms"

When the Major Received the Clearance" from the Sergeant he turned Round and Walked a few paces Seem-

ing to Examine" it Verry Minutely, in a few Minutues" he Returned—and Said—

How Long" have you been from Hobart Town—the Answer was from the Date of that Clearance" Have you Seen any Military parties in Search of Bushrangers", not any, Have you seen any Boats or Vessels on the Coast, Not any, When you Left Hobart Town Were you aware that Bushranger's Was out, Yes", Where was the Lieutenant Governor, it was Said he was gone to the Lakes", he asked Several other questions, he then Said Sergeant toake the Hand-cuffs" off those Men, the order was obeyed, he said Which of you is the person in Charge of this Boat Mr. Kelly answered, I am, Are you the Person Who was Master of the Brig Sophia" Some time ago at Hobart Town, I am, Have you Ever Seen me Before Mr. Kelly, O" yes, Repeatedly, Where, at Hobart Town I have Dined With you often at Mr. Birches" in the Castle* Still Holding the Clearance in his hand Reading it and Could Scarcely" Believe it he Said is it Usual" at Hobart Town to give Clearances" Such as this to open" Boats going Round the Coast, Mr. Kelly answered it Was" and Was always the Case Since Martial Law Commenced" in this Island he then Called the Mens Names over one by one from the Clearance" and asked them a Great many questions Still Looking Verry Suspisiously" at them

the Major said now Mr. Kelly" are you quite Sure you Know who I am, the answer" was O" yes I Cannot Mistake you, you are Major Stuart" of the 46th Reigment Commondant at Launceston—the Major then Said Mr. Kelly I am quite Satisfied Who you are give me your Hand and I am Verry Sorry for What has hapened that was puting yourself and your men in Irons" But had it not been for the Port Clearance" I Certainly Could not have Believed But you Were an associate" of Michael Howe the Bushranger", However you must Come up to the Government Cotage and accept of a Knife and fork and a bed at my quarters While you Remain at George Town—Sergeant you will haul Mr. Kellys Boat up Close to the Barracks—Let the oars etc. with the arrms" be secured in the Guard house and Let his Men Live With the Soldiers, give them plenty to Eat and Grog" but Dont Let them get Drunk,

Here was a Chang in the State of affairs" Mr. Kelly a Prisoner" in Handcuffs" and in a few Hours Released and Seated at the Majors" table Dining and partaking of a Bottle of his Best Wine," after Dinner the Major"

Related to Mr. Kelly that he had only Returned to to George Town, the Day previous that he had been out with a Strong party of Military" for the Last Six Weeks" Round the North East Coast in search of Howe" and his party but heard nothing of them

that he had Received Information that Howe" Intended to Lay Wait at the Entrance of the Tamer" to Capture a Boat or a Vessel" that he Might make his Escape over to the Coast of New Holland—Mr. Kelly Spent the Night in the Majors quarters and Having a good Nights Sleep on a good Bed Having been Sleeping in the open air by a fire Side for twenty five Nights Previous he awoke in the Morning and found himself Verry Much Refreshed his men was also well housed and good Beding in the Soldiers Barracks

10th January We Remained this Day at George Town under the Majors Hospitable Roof During the Dav he ordered the Seargeant to open the Public" Store and Issue to us as Much Provisions, Such as flour Tea Sugar Beef Pork Spirits etc. as we thought proper to ask for he also Remarked that the Mens Beding and Cloathing were not Suficient for Such a Voyage as we were on he ordered the Seargeant who was the Store Keeper to Issue to Each Man one Pair of Blankets and one Suit of Slops, this Being all Public Property Mr. K. offered to give a Draft on Hobart Town for the Whole amount of the Supplies We had Received but the Generous" Major said No you shall not pay any thing for What you have Receved I will account to the Government for all, you are on a Voyage of Discovery What you are Doing is for the Public Good and for the Good of this Colony—in the Evening Every thing was Ready to Start the Next Morning and took another Night of the Majors Hospitality—the Major prepared a Despatch adressed to the Lieutenant Governor at Hobart Town" informing him of What he had Done with Mr. Kelly" and that Mr. Kelly had offered his Services in the Event of him falling in with Howe" and his party to Return to George Town or proceed on to Hobart Town Which Ever might be most Convenient to inform the Government of Howes" Position—Mr. Kelly was also Requested that in the Event of him Coming in Contact with the Bushrangers to Destroy the Despatch for fear of them falling into Howes" Hands

it was not often that Communication Could be Had by the Government" betwen Hobart Town and George Town, in Consequence of Howes" Formidable' Position in the Bush" and Repeatedly Sending threatining Letters to

the Lieutenant Governor telling him that he Should open all his Despatches—and the Armed—Messengers" who Conveyed them if they Were Soldiers he would hang them up by the Heels to a tree Let thair Intrils out and Leave them Hanging Just as he would do a Kangaroo" and that he would Serve the Governor or any of his officers in the Same way but more Particularly" Mr. Humphrey the Police Magistrate" Who he termed his Bitter Enemy"—

11th January 1816—all this day it Blew a Strong Gale from the Northward Which prevented us from Launching but got our Boat and Geer in good order to Start the first fair Wind—12th January after Partaking of a Good Early Breakfast With the Major we Launched with a fine Breze from the Westward and was soon Clear of Port Dalrymple Having taken Leave of Major Stuart" and all his party thanking him and them for thair Kindness We Steered along the Coast to the Eastward and in the Evening hauled up on Waterhouse Island Where we Remaind the Night, before We Landed a Smoke was Seen opisite the Island on the Main Land Which we though might have been Howe and his party but on Looking with the Glass" we Saw it was a Large Mob of Natives Walking along the Beach

13th January at Daylight Launched with a fine Breze from the Westward and Clear Weather and Run along the Shore" to the Eastward at Noon Landed on Ringarooma" Point Here we Suddenly fell in with a Large Mob" of Natives Who at the first apearance Seemed Hostile but on Seeing Briggs, they all Knew him Well particularly the Chief Whose Name was Lamanbunganah" he seemed Delighted at Seeing Briggs and told him that he was at War with his own Brother Tolobunganah" Who was then on the Coast Near Eddistone" point, a most Powerful Chief Who Briggs also Knew Verry Well, Briggs at this time had on the Island two Wives and five Children that he had Left During his absence to Hobart Town, and had taken this trip in the Boat Round the West Coast thinking he might fall in with Some of his—Black Relations," Near Cape Portland, one of his Wives was a Daughter of the Chief Lamanbunganah" we just fell in with, Briggs Generally" Called his father in Law Laman" for Shortness the Chief Made Enquiry after his Daughter and was told that She and her Children Was Safe over on Cape Barren" Laman Said he Knew that for he Saw her Smokes almost Every Day"—after Some further Discourse Laman asked Briggs if he had any fire arms in the Boat he told them we Were

Well armed Laman Said he was Glad of that—as he had heard that five or Six White Men Well armed was with his Brother—Tolobunganah" at Edistone Point and that they Intended to Come and attack" him and Kill them all he Intreated Briggs to Join him and go and Meet them and Fight it out Briggs of Course Declined telling him that he had no Controle" over the Boat and that Mr. Kelly Could not agree to any Such proposeal," at this, Laman Seemed Verry much Dissatisfied and told Briggs in a Verry Hostile Tone that he had often Before gone with him to fight other Tribes" when he Wanted Women"—Laman then gave a Loud Cooe" and in two Minutes we Were Surrounded by above fifty Natives Laman" Said to Briggs now we Will force you to go with us and fight Tolo" he meant the Chief his Brother the White Men Spoken of We of Course thought must be Howe and his party—Briggs asked if they had a Boat Laman" Said no—

We now got Much alarmed at the Dangerous Situation" we Were in, and as an Excuse to get away—Briggs told Laman" that we would go over to Cape Barren and fetch his Wife Lamans" Daughter also that we would get five or Six of the Sealers to Join us with plenty of fire arms We would Come over and fight them Laman" Seemed much pleased and asked when we would go, Briggs Said we would Start Directly—Sleep to Night on Swan" Island and Tomorrow Morning go over To- to Cape Barren and Return in three Days Laman" and all his Mob was much pleased at this arrangement," the Boat was Launched We pulled to Swan Island and Hauled up for the Night, Much pleased with the Escape we made from Lamanbunganah" and his Mob—Had we Refused or Resisted his proposeal to fight he would have taken the Boat and Killed Every man of us as it was Impossible we Could have Stood against Such a Number of Natives

Briggs had been Employed as a Sealer" on the Islands in Bass' Straits for many years' Previously and had acquired the Native Language" of the North East Coast of Van Diemans" Land fluently in Consequence of often having gone over from the Isands To Cape Portland to Barter with the Natives for Kangaroo Skins also to purchase the Young Grown" up Native females to Keep them as their Wives and for Hunting Kangaroos" and Catching Seals, Both for thair Skins they Were Wonderfully Dexterous"

The Custom of the Sealers" in the Straits was that Every man Should have from two to five of those Native

Women for their own use and Benefit to select any of them they thought proper to Cohabit with as their Wives —In fact a Large Number of Children had been produced betwen these people the White man and the Black Woman and a fine active Race of People they Were Both for Hunting Kangaroo" and Catching Seals the men good Boat men the Women Good assistants to them, they were of a Light Copper Colour and Generally Verry good Looking—14th January, Launched from, Swan" Island with a Moderate Breze at North West and Steered along Shore to the South East. Soon after Leaving the Island we saw Smokes on the Shore and Some Natives walking on the Beach Which we Supposed to be our friend Laman and his tribe they Called and made Signals to us to Come on Shore but we took no Notice of them Having had so Narrow an Escape" the Day before Just Before Sun Set we hauled up on King George" Island or Rocks on a Small Sandy Beach" Not Wishing to give a Chance to Mr. Tolobunganah" to Serve us as Mr. Lamanbunganah" had Done the Day before for While we were on the Island we were Safe from thair atacks—Here we found a Large Number of Seals Laying on the Rocks Basking in the Sun, but having no Salt with us to Cure the Skins we thought it useless to Kill them. on the following Day the—15th January the Wind Set in at South East and fine Weather

We thought it Needless to Lay Idle" with a foul Wind and being Provided with Knives Steels and Clubs" and Being all old Hands at Sealing into the Bargain, we Commenced Killing and flinching" the Skin from the Body and Streching it out on the Grass with Wooden pegs it was Dried in the Sun and in one day Became Perfectly Cured this day by the above Process we Killed flinched and Peged out thirty Skins the following Day — 16th January we Killed flinched and Peged out twenty five Seal Skins—Wind Southerly and fine Weather—Several Smokes on the Shore oposite the Island and a Large Number of Natives on the Beach this day Caught ten young Cape Barren Geese" Which afforded us fresh Grub and with a little of the Majors fine pork we lived Sumptuously.

17th January this Day Wind South East and fine Weather found the Seals geting Shy of Coming up on the Rocks we gave them a Rest as it would not do to Storm them only at Low Water—at Noon—Launched the Boat and Went over to see the Natives and took with us four Seals Carcases that had been Skined and four young Pups alive about three Weeks old, we did not go Closeer to the

Beach than Musket Shot for fear" of Being Surprised by a Shot from Howe and his Party" Briggs Stood up in the Boat and Called out to the Natives in thair Language to Come to the Water Side, they seemed Shy untill he told them who he was When an old Man Rushed up to his Middle in the Water Briggs Called to him to Swim to the Boat Which he did we hauled him in turned out to be the old Chief Tolobunganah" he was over Joyed at Seeing Briggs and asked if he had Seen his Brother Laman" he Said No" Tolo" asked where we Came from Briggs said from Cape" Barren" by Way of Swan Island Tolo" said I Know that I Saw you Come from there. We then pulled a Little Distance along the Beach" to a Small Rock that lay off about fifty yards from the Shore. Tolo"-

Continud from first Book—

17th January 1816 from first Book Continud, Tolobunganah" Stood up in the Boat and Called to the x Natives" about twenty of them Came down to the Water Side they all Knew Briggs and Seemed Glad to See him, we made Tolo" a present of the four Dead Seals' and the four Live pups" at Which he seemed much pleased—Immediately after they got the Seals' Six Women Came Down to the Water Side Each with a Dead Kangaroo' on their Shoulders Tolo" ordered them to be Brought to the Boat—and Said that we Must Receive in Exchange for the Seals" we had Given them, that they had no more Kangaroo but tomorrow they would catch plenty, Tolo" Seemed anxious that we should Come on Shore We Declined

17th January 1816 Continued

by telling the Natives that we We did not wish to Come in Contact with the Six white men they had Seen" Tolo" asked if we Were Frightened of them, Briggs said no—but they were bad men and we Wanted to Know Whereabouts" they was—

all these Excuses" we was obliged to make to get all the friendly" Information we Could from the Natives Relative to Howe and his Party as we were still of opinion that they was Near at Hand but the Natives assured us that they was Gone a Long Distance to the Southard towards Saint Patricks" head we took Leave of Tolo" and his Mob in the Evening" and told them that we Should Come over Next day and Bring them More Seals at Which they Seemed Delighted and Said that if we Brought them plenty of Seals, they would give us plenty of Kangaroo" and thair Skins in Return—the Wind being fair we Run over to the Island Hauled the Boat up' and Had a good Kangaroo Steamer for Supper the first we had this Voyage.

18th January 1816 at day Light it being Low Water there was a good Number of Seals' up on the Rocks" we Stormed them, and Killed, twenty Which we Skined and peged" out to Dry the Weather was Verry fine Wind from the South East, this, day found the fresh Water on the Island geting Short and Verry Brackish, Launched the Boat and put our three Water Kegs into her to get the Natives" to fill them with fresh Water we also put into the Boat twenty of the Seals" Carcases' to Barter With the Natives for Kangaroo Skins, we also took Six young Seal pups alive as presents, Eearly in the morning Signal Smokes' was made on the Beach for us to Come over according to Promise"

on arriveing at the Beach We did not See a Native" Which Made us think there was something the Matter we waited about half an hour When we saw Tolobunganah" Make his appearance on the Beach" We Called to him to Come to the Rock Where he had been the day previous' he Came we asked him why he did not Come to the Boat when we first arrived he said that all the Natives' was in the Bush" Hunting Kangaroo" and geting Skins but they would be Here Shortly, we had still a Suspision that Howe" was with the Natives but Tolo" assured us he was not we told him we wanted our three Kegs' filled with fresh Water and that we Would Buy all the Kangaroo Skins he had; in about twenty Minutes" the Whole tribe Came down on the Beach there were about Two. Hundred Men Women" and Children' and at Least fifty Dogs" on seeing them aproach we pulled the Boat out from the Shore a Little Distance Leaving Tolo" on the Rock and got our Arms" and Examined them, to see that they were in fireing order We held up 3 or 4 Seals Carcases" and told them we Wanted to Barter for Kangaroo Skins Tolo" ordered Ten Women" to go into the Water Each Loaded With Kangaroo" and Skins we then gave the Women the Seals Carcases" we Brought over they Carried them to the Mob and Returned Immediately to the Boat With another Load of Skins as Payment for the Seals" we then Requested Tolo" to fill our Kegs with fresh Water Which he Did but we would not Let them take away more than one Keg at a time for fear they should not Bring them all Back at Which Tolo" Seemed Displeased—

The Natives asked if we Would Bring over more Seals Tomorrow Briggs told them they were geting Scarce and Shy of Being Caught Tolo" told Briggs We had Better take Some Women over to the Island to assist in Catching Seals" at Which they Were Verry Dexterous" This Being agreed on Tolo" ordered Six Stout Women to

go into the Boat' which they Did and seemed Delighted the Wind being fair We run over to the Island Hauled the Boat up, and Peged the Kangaroo" Skins out to Dry, the Women on Seeing the Seals on some of the outer Rocks Were Verry anxious" to Commence" Catching them, Briggs having Been a Long time on the Islands in Bass' Straits with the Native Women as a Sealer was Well Acquainted with the Mode of them Catching Seals" and a Most Singular Mode it is, It is here Described

We gave the Women Each a Club that We had used to Kill Seals" with they went to the Waters Edge and Wet themselves" all over thair head and Body as they Said to Prevent the Seals from Smeling them as they Walked along the Rocks they Were Verry Cautious not to go to Windward of them as they Said a Seal Would sooner Belive his Nose than his Eyes" When a Man or Woman Came Near him, the Six Women Walked into The Water two and two and Swam to three Rocks about 50 yards from the Shore Each Rock, had about 9 or 10 Seals on it they were all Laying aparently asleep, Two Women went to Each Rock with thair Clubs in hand Each of them Crept Slowly Close up to their Seal and Lay Down with thair Club alongside them Some of the Seals aRose thair heads up to Look at thair New Visitors and Smell them Scratchd themselves and Lay Down again—this Was Done by thair fin or flipper

the Women Went Nearly through the Same Motion as the Seal Did by holding up the Left Elbow a little and Scratching themselves With thair Left hands Keeping the Club firm in the Right hand Ready for the attack—the Seals Seemed Verry Cautious" Now and then Lifting up thair heads Looking around Scratching themselves with thair flippers and Laying their heads Down again, the Women went through the Same Motions as Near as possible—after they had been Laying on the Rocks for Nearly an hour the Sea ocationly washing over them and they quite Naked We—Could not tell thair meaning for Remaining So Long all of a Sudden the Women aRose" up on thair Seats thair Clubs up at arms Length—Each Struck a Seal on the Nose Which Killed him, and in an Instant they all Jumped up as if by Magic and Killed one More Each, after giving the the Seals Several Blows on the head and Securing them, they Commenced Loud Laughing and Dancing as if they had gained a great Victory" over the Seals, Each of them Draged a Seal into the Water and Swam with it to the Rock Where we was Standing and then Swam Back to the Rock and Brought one more Each Which made twelve Seals the Skins of Which being worth

one pound each in Hobart Town Was not a Bad Begining by the Black Ladies, the Six Women then went to the top of a Small Hill and Made Smoaks as Signals to the Natives on the Main that they had been Killing Seals Which was soon answered by Smoaks" on the Beach We Skined the Seals and peged them out to Dry the Women then Commenced—Cooking their Supper Each Cut a Shoulder off a young Seal Weighing three or four pounds and threw them on the fire When they were about Half Done they Commenced Devouring them and Rubing the oil on thair Skin Saying they had a Glorious Meal.

19th January 1816

at Daylight being Low Water the Women Began Killing Seals they would not Let us Come Near untill they had Killed all that Could be got on the Beach they Killed twenty six before Brakfast, the Weather being fine Wind South East, the Remainder of the Day was Spent Catching and Killing Seals Principally by the Women

20th January 1816

at Sun Rise Smoaks were made on the Main, the Women Said they were Signals for us to Come over we were Employed untill Noon Killing and Skining Seals Mostly by the Women Swiming to the outer Rocks the Seals geting Verry Shy we only Succeeded in geting Sixteen Skins in the Evening Launched the Boat and Went over to the Main Took two of the Women and Loaded the Boat with Carcases of the Seals we had Skined, on arrival at the Beach Tolobunganah" was there the two Women told him What we had Done he was Delighted to See the Boat Loaded with Seals he told us he had plenty of Kangaroo and Skins for us in payment for the Seals We threw the Seals into the Water the two Women Draged them to the Beach Tolo ordered the Mob, to take them all into the Bush in a few Minutes they Returned with ten Dead Kangaroo and about Ninety Skins Tolo Enquired how Long we Should want the Women we told him about two or three days as the Seals were geting Scarce we should not Stay Longer he ordered the two Women to go over with us and Stop as Long as we Required them the Wind being from the Westward we Run over to the Island and hauled the Boat up the four Women we left on the Island informed us that During our absence they had Caught Six Seals.

21t January 1816

During this Day fresh Brezes at South West and fine Weather Employed Drying and packing Skins in Bundles

Ready for a Start, Killed and Skined Eleven Seals the Women Employed Roasting a Large Number of Seals--Flippers and Shoulders Ready to take over with them they informed us that if We gave them Some Seals for the trouble they had been at in Catching them the Chief Tolo' would not Let them Keep them but if the Shoulders and flippers Were Roasted they Might Keep them and do as they pleased with them so the Ladies were Determined to have a good Stock of fresh Meat to take home with them

22d January 1816

During this Day the Wind blew—Strong from the Eastward and thick Weather, Killed and Skined Eleven Seals the Women Employed Roasting Seals Shoulders and flippers

23d January 1816

first part of this Day fresh Brezes from the Southard and fine Weather the Women Killed five Seals on the outer Rocks at Noon Loaded the Boat with Seals Carcases the Women and thair Roasted Meat and took them over to the Main on our arrival at the Beach Tolo" and all his Mob Came Down they had a few Dead Kangaroo and about fifty Skins they Were Verry Much pleased to See the Boat Loaded with Dead Seals, we threw them out of the Boat Tolo" ordered them to be put in a Heap on the Beach, he also ordered the Six Women to take thair Roasted flippers and Shoulders into the Bush, Briggs then told Tolo" that we Should Start Tomorrow from the Island and that we should now take our Leave of them at Which the Women all Began to Cry" in Fact the Whole Mob Seemed full of Sorrow that we Were about to Leave them Tolo" then told Briggs not to go away untill they Had a Dance, the Whole Mob about three Hundred in Number formed a Line in three Divisions the Men in one the Women in one and the Children in one Tolobunganah then gave the Signal to Commence the Dance and a most Singular Dance it was, the Women Began in the Center with a Song Joining thair hands forming a Circle and Dancing Round the Heap of Dead Seals then throwing themselves Down on the Sand and puting themselves into Most Singular attitudes Beating the Lower part of thair Bodies with thair hands and Kicking the Sand over Each other With thair feet the Men and Children Laughing Verry Much Seeming to Enjoy the Sport the Women then all Sat Down. the Children had a Similar Dance to the Woman and Sat Down the Men then Commenced a Sort of Sham fight with Spears and Waddies then Dancing Round the heap of Dead Seals' and Sticking

thair Spears into them as if they Were Killing them all this Lasted about an hour Tolo then told us the Dance was over he asked Briggs Where we Where going when we Left the Isand Brigges told him we Where going to Cape Barren and if he Saw the White Men Meaning Howe and his party to tell them So this was to Deceive them in Case they Should try to Waylay us on our way to Hobart Town the Wind being fair we Run over to the Isand hauld the Boat up and Began to pack our Skins Ready for a Start Next Morning if the Wind and Weather should Permit

24th January 1816

at Sun Rise the Wind North West and fine Weather Launched the Boat got all the Skins Provisions &c. into her after Breakfast Started with a fine Breze at North and Steered along Shore to the Southard the Natives made three Smoaks to Say good Bye We found after Leaving King George' Island and Rocks we had been there Nine Days and had procurd one Hundred and Seventy two Seal skins and two Hundred and forty six Kangaroo Skins from the Natives, the Whole Value of Which is £180 at Hobart Town we Run to the Southard untill Sun Set When we hauled up for the Night on a Small Sandy Beach at the South Side of the Bay of fires —

25th January 1816

Throughout this day strong Brezes from the Westward at Sun Rise Launched and Stood along Shore to the Southard under the Reefed Lug in the Evening Squally with Rain Hauled up on a Small Beach under Saint Patricks Head for the Night

26th January 1816

all this Day Strong Brezes from W S W, at Sun Rise Launched and pulled along Shore to the Southard a Heavy Swell Seting from the Southard in the afternoon Hauled up in Waubs" (4) Boat Harbour a Heavy Surf on the Beach Half filled the Boat Landing Which Wet all the skins

27th January 1816

all this day fresh Gales at South West Employed Drying the Skins and Cleaning the arms in the Evening a Small party of Natives Came along the Beach Close to

(4.) [The reference to Waub's Harbour is of interest. This designation was apparently given to the locality in honour of Waubedebar, an aboriginal woman who was probably of some importance in the district, as on her death she was buried there, and a stone erected to her memory. The inscription on the stone is as follows:—"Here lies "Waubedebar a female aborigine of Van Diemans Land died June "1832, aged 40 years. This stone was erected by a few of her white "friends."—Ed.]

us but Seeing our Number they Returned and went into the Bush

28th January 1816

all this Day Light Brezes at North West and fine Weather at Daylight Launched and Stood along Shore to the Southard at Noon Passed Wine Glass Bay Winds Light pulling along Shore to the Southard at Sun Set Hauled up on the North Side of Schouten Island in the Boat Harbour for the Night Saw a Large Number of Natives on the Island Which Caused us to Keep Watch During the Night for fear of an attack by them

29th January 1816

at Daylight a fine Breze from the Northward, Launched and Stood Round the West End of the Island at 8 a m Landed on the White Rock in oyster bay and Killed Six Seals" put thair Skins into the Boat and Made sail to the Southard Saw Several Natives on Maria" Island Runing along the Beach Calling to us to Come on Shore Which we Declined in the Evening Hauled up in the Inlet Near East Bay Neck and Began to Carry our things over the Neck Ready to Haul the Boat over Next morning——

30th January 1816

at Daylight Hauled the Boat over East Bay Neck got all the things into her and Made Sail for Hobart Town With a fine Breze from the Northward at Noon passed Iron Pot Island and Entered the Derwent at 4 P M arrived at Hobart Town Discharged the Boat and Hauled her up — this Day finishes our Voyage of Discovery Round Van Diemans Land Having Been Forty Nine Days absent Without Meeting with any accident or Danger further than what is Contained in this Journal" Which is a true Narative of What Tranpired"

James Kelly.

ABSTRACT OF PROCEEDINGS
1920

Annual Meeting.

The Annual General Meeting was held at the Museum on 8th March, 1920, His Honor the Chief Justice (Sir Herbert Nicholls) presiding.

The Annual Report and Statement of Accounts were read and adopted.

The following were elected as Members of the Council for 1920:—Rt. Rev. R. S. Hay, D.D., Dr. A. H. Clarke, M.R.C.S., Dr. W. L. Crowther, D.S.O., M.B., Messrs. W. H. Clemes. B.A., B.Sc., L. Dechaineux, T. W. Fowler, J. A. Johnson, M.A., L. Rodway, C.M.G., and C. C. Thorold, M.A. Mr. R. A. Black was appointed Auditor for 1920.

Illustrated Lecture.

Mr. Clive Lord delivered an illustrated lecture on "The National Park of Tasmania."

Conversazione.

After the business of the meeting was concluded an adjournment was made to the Art Gallery, where a conversazione was held.

12th April, 1920.

The Monthly Meeting was held at the Museum on 12th April, Mr. L. Rodway, C.M.G., presiding.

The following Members were elected:—A. W. Swindells, H. Nowotny, T. P. Arnold, R. S. Burdon, R. W. Canning, B. Whitington.

Paper.

Studies of Tasmanian Cetacea, No. 4 (*Delphinus delphis*). By H. H. Scott and Clive Lord.

Lecture.

Mr. D. B. Copland delivered an instructive lecture upon "Currency Inflation and Price Movement in Australia during the War."

10th May, 1920.

The Monthly Meeting was held at the Museum on 10th May, His Excellency, Sir William Allardyce, presiding.

Mr. L. Rodway, C.M.G., Vice-President, extended a hearty welcome to His Excellency upon taking his seat as President of the Society.

Major L. F. Giblin, D.S.O., was elected a member of the Council, in place of Mr. T. W. Fowler (resigned).

Paper.

"Preliminary Note upon the Discovery at Smithton of a Skeleton of *Nototherium mitchelli*." By H. H. Scott and Clive Lord.

Illustrated Lecture

Mr. L. G. Irby, Conservator of Forests, delivered an illustrated lecture on "Forestry."

8TH JUNE, 1920.

The Monthly Meeting was held at the Museum on 8th June, Mr. L. Rodway, C.M.G., presiding.

The following members were elected:—Dr. W. I. Clark, Messrs. J. H. Gillies and F. B. Cane.

Papers.

"Studies of Tasmanian Mammals, Living and Extinct." Part II. By H. H. Scott and Clive Lord.

"Australian Stratiomyiidæ." By G. H. Hardy.

Illustrated Lecture.

Mr. L. Rodway delivered an illustrated lecture on the "Proposed Road to the West Coast."

12TH JULY, 1920.

The Monthly Meeting was held at the Museum on 12th July, His Excellency the Governor (Sir William Allardyce) presiding.

The following members were elected:—Messrs. T. Hytten and T. W. Blaikie.

Paper.

"A Revised Census of the Tasmanian Fluviatile Mollusca." By W. L. May.

Illustrated Lecture

Mr. Frank Ellis, M.A., B.E., delivered an illustrated lecture, entitled "Notes on Vocational Training."

9TH AUGUST, 1920.

The Monthly Meeting was held at the Museum on 9th August, His Excellency the Governor (Sir William Allardyce) presiding.

Paper.

"Studies in Tasmanian Mammals, Living and Extinct." Part III. By H. H. Scott and Clive Lord.

Lecture.

Mr. H. T. Parker delivered a lecture, entitled "Mental Efficiency: An Experimental Study, based on the Binet-Simon Intelligence Tests."

13TH SEPTEMBER, 1920.

The Monthly Meeting was held at the Museum on 13th September, 1920, Mr. L. Rodway, C.M.G., presiding.

Papers.

"Studies in Tasmanian Mammals, Living and Extinct." Part IV. By H. H. Scott and Clive Lord.

"A Catalogue of the Osteological Specimens relating to the Tasmanian Aborigines, contained in the Tasmanian Museum." By Dr. W. L. Crowther and C. E. Lord.

"The Early History of Bruny Island." By C. E. Lord.

Lecture.

Dr. W. L. Crowther delivered a lecture on "The Aborigines of Tasmania."

11TH OCTOBER, 1920.

The Monthly Meeting was held at the Museum on 11th October, Dr. A. H. Clarke, M.R.C.S., presiding.

The following members were elected:—Mrs. Cranstoun, Dr. Orr, and Mr. A. D. Bernacchi.

Paper.

"Additions to the Fungus Flora of Tasmania." By L. Rodway, C.M.G.

Lectures.

Short Lecturettes, dealing with "Education for Community Life," were delivered by Messrs. J. A. Johnson, D. B. Copland, C. E. Fletcher, L. Dechaineux, and S. R. Dickenson.

8TH NOVEMBER, 1920.

The Monthly Meeting was held at the Museum on 8th November, 1920, Mr. L. Rodway, C.M.G., presiding.

The following member was elected:—Hon. W. M. Williams, M.L.C., O.B.E.

Lecture.

Mr. W. H. Clemes, B.A., B.Sc., delivered an illustrated lecture on "The Geology of the Hobart Reservoir Sites."

ANNUAL REPORT

The Royal Society of Tasmania

1920

Patron:
HIS MAJESTY THE KING.

President:
HIS EXCELLENCY SIR W. L. ALLARDYCE, K.C.M.G.
GOVERNOR OF TASMANIA.

Vice-Presidents:
E. L. PIESSE, B.Sc., LL.B
L. RODWAY, C.M.G.

Council:
(Elected March, 1920).

A. H. CLARKE, M.R.C.S., L.R.C.P. *(Chairman)*
W. H. CLEMES, B A., B.Sc.
W. E. L. CROWTHER, D.S.O., M.B.
L. DECHAINEUX
T. W. FOWLER (resigned May, 1920)
L. F. GIBLIN, D.S.O. (elected June, 1920)
RT. REV. R. S. HAY, D.D.
J. A. JOHNSON, M.A.
L. RODWAY, C.M.G.
C. C. THOROLD, M.A.

Standing Committee:
A. H. CLARKE, L. RODWAY, AND C. C. THOROLD

Hon. Treasurer:
L. RODWAY.

Editor:
C. E. LORD.

Auditor:
R. A. BLACK.

Secretary and Librarian:
CLIVE E. LORD

LIST OF MEMBERS.

Honorary Members:

David, Sir T. W. Edgeworth, K.B.E., C.M.G., B.A., F.R.S., F.G.S., Professor of Geology and Physical Geography in the University of Sydney. The University, Sydney.

Mawson, Sir Douglas, B.E., D.Sc. Adelaide.

Shackleton, Sir Ernest H., Kt., C.V.O., F.R.G.S., F.R.A.S. 9 Regent-street, London, S.W., England.

Spencer, Sir W. Baldwin, K.C.M.G., M.A., D.Sc., Litt.D., F.R.S. Melbourne.

Ordinary, Life, and Corresponding Members:

"C," Corresponding Member.
"L," Member who has compounded subscriptions for life.
*, Member who has contributed a Paper read before the Society.
†, Member who has been elected a member of the Council.

Year of Election.		
1916		Ansell, M. M., B.A. The Registrar. The University, Hobart.
1920		Arnold, T. P. Ferndene Avenue.
1918	L	Avery, J. Electrolytic Zinc Co. Risdon.
1908	L	Baker, Henry D. C/o American Consulate, Hobart.
1887		Barclay, David. 143 Hampden Road, Hobart.
1890		*Beattie, J. W. 1 Mount Stuart Road, Hobart.
1918		Bellamy, Herbert. City Engineer. Town Hall, Hobart.
1901	C	Benham, W. B., M.A., D.Sc., F.R.S., F.Z.S. Professor of Biology, University of Otago. Dunedin, New Zealand.
1903		Bennett, W. H. "Ashby," Ross.
1918		Bennett, A. E. "Ashby," Ross.
1900		Bennison, Thomas. 29 Cromwell Street, Hobart.
1918		Bennison, E. A. Napoleon Street, Battery Point.
1920		Bernacchi, A. G. D. Maria Island.
1918		Bisdee, E. O. Lovely Banks, Melton Mowbray.
1912		*Black, R. A. Chief Clerk, Department of Agriculture.
1909		*Blackman, A. E. Franklin.
1920		Blaikie, T. W. Practising School, Elizabeth Street.
1918		Bowling, J. "Clovelly," Risdon Road.
1892	C	Bragg, W. H., M.A., F.R.S. Professor of Physics in University College, London.

Year of Election.		
1917		Brettingham-Moore, Dr. E., M.B., Ch.M. Macquarie-street, Hobart.
1911		Brooks, G. V. Director of Education. Education Department, Hobart.
1907		Brownell, F. L. "Leura," Main Road, Moonah.
1918		Bryer, J. R. Taroona.
1918		Burbury, Alfred. "Glen Morey," Antill Ponds.
1919		Burbury, Charles. "Inglewood," Andover.
1918		Burbury, Frederick. "Holly Park," Parattah.
1919		Burbury, Gerald. "Syndal," Ross.
1919		Burbury, T. J. "Park Farm," Jericho.
1920		Burdon, R. S., B.Sc. The University of Tasmania.
1909		†*Butler, W. F. D., B.A., M.Sc., LL.B. Bishop Street, New Town.
1917		Butters, J. H. Chief Engineer and Manager State Hydro-Electric Department, Hobart.
1920		Cane, F. B. 90 High Street, Sandy Bay.
1920		Canning, R. W. The University, Hobart.
1919		Chapman, A. D. 105 Macquarie Street.
1912		Chapman, J. R. Holebrook Place, Hobart.
1901	C	Chapman, R. W., M.A., B.C.E. Elder Professor of Mathematics and Mechanics in the University of Adelaide. The University, Adelaide.
1913		Chepmell, C. H. D. Clerk of the Legislative Council, Hobart.
1920		Clark, W. I., M.B. Macquarie Street, Hobart.
1896		†*Clarke, A. H., M.R.C.S., L.R.C.P. Macquarie Street, Hobart.
1918		Clarke, T. W. H. Quorn Hall, Campbell Town.
1887		†Clemes, Samuel. Principal of Leslie House School. Clare Street, New Town.
1910		†*Clemes, W. H., B.A., B.Sc. Leslie House School, Argyle Street, New Town.
1918		Conlon, A. Agricultural Department, Hobart.
1917		Copland, D. B., M.A. Lecturer in History and Economics. The University, Hobart.
1920		Cranstoun, Mrs. L. A. 158 Macquarie Street, Hobart.

Year of Election.		
1917		Cullen, Rev. John. Macquarie Street, Hobart.
1918		*Cummins, W. H., A.I.A.C. Lindisfarne.
1919		†*Crowther, W. L., D.S.O., M.B. Macquarie Street, Hobart.
1884		Davies, The Hon. C. E., M.L.C. "Lyndhurst," New Town Road, New Town.
1919		Davies, H. Warlow-, C.E. "Abermere," Mount Stuart.
1908		†Dechaineux, Lucien. Principal of Technical School, Hobart.
1903		Delany, Most Rev. Patrick. Archbishop of Hobart. 99 Barrack Street, Hobart.
1892	C	Dendy, A., D.Sc, F.R.S., F.L.S. Professor of Zoology in the University of London (King's College). "Vale Lodge," Hampstead, London, N.W.
1919		Elliott, E. A., M.B. Macquarie Street.
1918		Ellis, F. Education Department, Hobart.
1919		Erwin, H. D., B.A. Christ's College, Hobart.
1918		Evans, L. Acting Director of Agriculture, Hobart.
1902		Finlay, W. A. 11 Secheron Road, Hobart.
1918		Finlay, G. W. "Baskerville," Campbell Town.
1918		Fletcher, C. E. Education Department, Hobart.
1909		†*Flynn, T. Thomson, B.Sc. Ralston Professor of Biology in the University of Tasmania.
1890	L	Foster, Lieut.-Colonel H. Merton Vale, Campbell Town.
1905	L	Foster, J. D. "Fairfield," Epping.
1913		†Fowler, T. W., M.Inst. C.E. Uhls Building, Brisbane, Queensland.
1918		Gatenby, R. L. Campbell Town.
1908		†*Giblin, Major L. F., D.S.O., B.A. Government Statistician, Davey Street.
1918		Gillett, Henry. "Wetmore," Ross.
1920		Gillies, J. H. Macquarie Street.
1913		†*Glasson, J. L., M.A., D.Sc. C/o Agent-General for Tasmania, London.
1918		Gould, J. W. Tramway Department, Hobart.
1907		Gould, Robert. Longford.

Year of Election.		
1905	L	Grant, C. W. "High Peak," Huon Road.
1913		*Hardy, G. H. Hurlstone. C/o Australian Museum, Sydney.
1918		Harrap, Lieut.-Colonel G. E. Launceston.
1902	C	Haswell, William, M.A., D.Sc., F.R.S., F.L.S. Challis Professor of Biology in the University of Sydney. The University, Sydney.
1913		Hawson, Edward. "Reminé," 174 Argyle Street, Hobart.
1919		Hay, Rt. Rev. R. S., D.D., Bishop of Tasmania. Bishopscourt, Hobart.
1915		Hickman, V. V., B.Sc. Garden Road, Albert Park, Moonah.
1919		Higgins, Dr. P. Campbell Town.
1913		Hills, Loftus, M.Sc. Government Geologist. Launceston.
1914		Hitchcock, W. E. Moina.
1908		Hogg, G. H., M.D., C.M. 37 Brisbane Street. Launceston.
1909		*Hutchison, H. R. 1 Barrack Street, Hobart.
1920		Hytten, T. "Eltham," Bathurst Street.
1913		Ife, G. W. R., LL.B. Summerhill Road, Hobart.
1919		Irby, L. R. Conservator of Forests. Lands Department, Hobart.
1898		*Ireland, E. W. J., M.B., C.M. Launceston General Hospital.
1918		Innes, H. S. 71 Davey Street, Hobart.
1919		Jackson, Geo. A. Tregear's Building, Collins Street.
1906		*Johnson, J. A., M.A. Principal of the Philip Smith Training College, Hobart. "Wharepuke," Argyle Street, New Town.
1911		Keene, E. H. D. Tantallon, Tarleton (A.I.F.).
1910		Kermode, R. C. "Mona Vale," Ross.
1918		Kermode, Lewis Q., B.A. Birkdale, Lancashire, England.
1913		Knight, J. C. E. "Windermere," Claremont.
1918		Knight, C. E. L., B.Sc. Claremont.
1919		Knight, H. W. National Mutual Buildings, Macquarie Street.
1919		Leahy, F. T. Electrolytic Zinc Company, Risdon.

Year of Election.		
1887		†Lewis, Sir Neil Elliott, K.C.M.G., M.A., B.C.L., LL.B., M.H.A. "Werndee," Augusta Road, New Town.
1919		Lewis, A. N. "Werndee," Augusta Road.
1912		†Lindon, L. H., M.A. "The Lodge," Park Street, Hobart.
1900		Lines, D. H. E., M.B., Ch.B. Archer Street, New Town.
1875	C	Liversidge, Professor Archibald, M.A., LL.D., A.R.S.M., F.R.S., F.I.C., F.C.S., F.G.S., F.R.G.S. "Fieldhead," Coombe Warren, Kingston, Surrey, England.
1913		†*Lord, Clive E.. Curator and Secretary of the Tasmanian Museum, Hobart. "Cliveden," Mt. Nelson Road, Sandy Bay.
1912		McAlister, Miss M. K. Rosetta.
1893		*McAulay, Alexander, M.A. Professor of Mathematics in the University of Tasmania. The University, Hobart.
1902	C	*Maiden, J. H., I.S.O., F.R.S., F.L.S. Director of Botanic Gardens, Sydney, and Government Botanist of New South Wales. Botanic Gardens, Sydney.
1918		Mansell, A. E. Melton Mowbray.
1918		Martin, Colonel W., V.D. Launceston.
1913		Mather, J. F. 1 Mount Stuart Road, Hobart.
1919		Mackay, A. D., B.Sc., M.M.E. 4 Fawkner Street, South Yarra, Victoria.
1895		*May, W. L. "Forest Hill," Sandford.
1909		Millen, J. D., Senator. Roxburgh, Newstead.
1907		Miller, Lindsay S., M.B., Ch.B. 156 Macquarie Street, Hobart.
1894	L	Mitchell, J. G. "Ellesmere," Jericho.
1913		Mitchell, P. H., B.A. Headmaster of the State High School, Hobart. 2 Ashfield Street, Queenborough.
1911		Montgomery, R. B. Davey Street.
1918		Murdoch, Thomas. Montpelier Road, Hobart.
1882		Nicholas, G. C. "Cawood," Ouse.
1918		Nicholls, Sir Herbert, Kt. Chief Justice of Tasmania. Pillinger Street, Queenborough.
1910		Nicholls, H. Minchin. Government Microbiologist, Department of Agriculture. Macquarie Street, Hobart.

Year of Election.		
1919		Nicolson, Norman. "Streanshalh," Campbell Town.
1920		Nowotny, H. Hutchins School, Hobart.
1917		Oldham, N., J.P. New Town.
1919		Oldmeadow, H. E. R. "Lowes Park," Woodbury.
1920		Orr, Dr. Hubert, Campbell Town.
1908		Parsons, Miss S. R. 190 Davey Street, Hobart.
1888	C	Pearson, W. H., M Sc., A.L.S. 18 Palatine Road, Withington, Manchester, England.
1902		†*Piesse, E. L., B.Sc., LL.B. 39 Broadway, Camberwell, Victoria.
1910		Pillinger, James. 4 Fitzroy Cresecent, Hobart.
1918		Pitt, Frank C. K. "Glen Dhu," The Ouse.
1919		Pitt, C. F. Campbell Town.
1908		Pratt, A. W. Courtney. "Athon," Mt. Stuart Road, Hobart.
1919		Riggall, Captain A. Horton, D.S.O. Tunbridge.
1919		Robertson, J. Moore. Sandy Bay.
1918		Robertson, T. W. Box 93, G.P.O., Hobart.
1919		Rowland, E. O. Secretary Public Service Board, Hobart.
1884		†*Rodway, Leonard, C.M.G. Government Botanist of Tasmania. Macquarie Street, Hobart.
1913		Ross, Hector. Sheriff of Tasmania. Elphinstone Road, Hobart.
1915		Ross, J. Head Teacher, New Town School, New Town.
1896		Scott, R. G., M.B., Ch.M. 172 Macquarie Street, Hobart.
1919		Sharland, A. Campbell Town.
1892	C	*Shirley, John, D.Sc. Principal, Teachers' Training College, Queensland. "Coot-tha," Bowen Hills, Brisbane.
1901		Shoobridge, Canon G. W. 3 Molle Street, Hobart.
1917		Slaytor, C. H., F.I.C. Haxey, Doncaster, England.
1919		Smith, G. O., B.Sc., B.M.E. Town Hall, Hobart.
1919		Smith, G. O., Mrs., B.Sc. 75 Burnett Street.

Year of Election.		
1901	C	Smith, R. Greig-, D.Sc. Linnean Hall, Elizabeth Bay, Sydney.
1919		Snowden, Colonel R. E. "Minallo," West Hobart.
1896	L	*Sprott, Gregory, M.D., C.M. Macquarie Street, Hobart.
1919		Stevenson, Miss F. "Leith House," New Town.
1896	L	Sticht, Robert, B.Sc., E.M. Mount Lyell Mining and Railway Co. Ltd., Queen Street, Melbourne.
1913		Susman, Maurice. 88 Murray Street, Hobart.
1920		Swindells, A. W. 141 Campbell Street.
1907		Tarleton, J. W. 108 High Street, Queenborough.
1887		*Taylor, A. J. Librarian of the Tasmanian Public Library. 28 D Arcy Street, Hobart.
1918		Taylor, Walter E. Elboden Street, Hobart.
1892	C	*Thomson, G. M., F.L.S. Dunedin, New Zealand.
1198		†Thorold, C. C., M.A. Hutchins School, Hobart.
1918		Walch, Percy. King Street, Sandy Bay.
1901	C	Wall, Arnold, M.A. Professor of English Language and Literature in Canterbury College. Christchurch, New Zealand.
1913		Wardman, John. Superintendent of the Botanical Gardens. Botanical Gardens, Hobart.
1918		Waterhouse, G. W., B.A., LL.M. Cantab. Messrs. Ritchie and Parker, Alfred Green and Co., Launceston.
1918		Watt, W. The Observatory, Hobart.
1918		Weber, A. F. Lands Department, Hobart.
1919		Williams, T. H. Electrolytic Zinc Company, Risdon.
1920		Williams, Hon. W. M., M.L C., O.B.E., Hobart.
1901		Wise, H. J. Lambert Avenue, Sandy Bay.

Members are asked to inform the Secretary of any change of address or other necessary correction.

ANNUAL REPORT.

In accordance with Rule 39, the Council present a Report of the proceedings of the Society for 1920.

The Council and Officers.

The Annual Meeting was held on the 8th March, 1920, and the following members were elected as the Council for 1920:—Rt. Rev. R. S. Hay, Dr. A. H. Clarke, Dr. W. L. Crowther, Messrs. W. H. Clemes, L. Dechaineux, T. W. Fowler, J. A. Johnson, L. Rodway, and C. C. Thorold.

Ten Council meetings were held during the year, the attendance being as follows:—Dr. Clarke, 10; Dr. Crowther, 9; Mr. Rodway, 9; Mr. Clemes, 8; Mr. Johnson, 8; Mr. Thorold, 6; Mr. Dechaineux, 5; Major Giblin (elected June), 3; Rt. Rev. R. S. Hay (on leave of absence in England from April), 2; Mr. Fowler (resigned May), 1.

The Council, at its first meeting, elected the following officers:—Chairman, Dr. Clarke. Standing Committee, Dr. Clarke, Messrs. Rodway and Thorold. Editor of Papers and Proceedings, C. E. Lord. Hon. Treasurer, L. Rodway. Secretary and Librarian, C. E. Lord.

The Council elected Drs. Clarke and Crowther, Messrs. Clemes, Dechaineux, Johnson, and Rodway to be Trustees of the Tasmanian Museum and Botanical Gardens.

During the year Mr. Fowler resigned, and Major L. F. Giblin was elected in his place.

Meetings.

During the year nine ordinary meetings of the Society were held. In addition to the papers read there were several instructive illustrated lectures delivered at the meetings. The attendances showed a considerable improvement upon those of the past few years.

Membership.

The membership of the Society continues to increase, and the roll at the end of the year showed that there were four Honorary Members, twelve Corresponding Members, eight Life Members, and one hundred and fifty Ordinary Members.

Midlands Branch.

During the year the activities of the Society were extended by the formation of a Branch of the Society in the Midlands. The inaugural meeting was held at Campbell Town on September 30th. Mr. R. C. Kermode, who has shown considerable interest in this matter, was elected Chairman of the Branch.

Psychology and Education Section.

Seven meetings were held during the year, and were well attended.

Officers.—J. A. Johnson, Chairman; W. H. Clemes, Hon. Secretary.

The following Papers were read and discussed:—"Reconstruction in Education," J. A. Johnson; "Ideals of Community Life," D. B. Copland; "The Curriculum as an Instrument of Training for Community Life," C. E. Fletcher; "General Education and Vocational Training in the Community," L. Dechaineux; "Culture and Community Life," S. R. Dickinson; "Authority and Freedom," L. F. Giblin.

Obituary.

It is with regret that the Society has to record the death of the following Members during the past year:—W. A. Harvey, M.B., of Hobart (elected a member in 1893); George Kerr, of Hobart (elected a member in 1905).

ROYAL SOCIETY OF TASMANIA

RECEIPTS AND EXPENDITURE, 1920. GENERAL ACCOUNT.

RECEIPTS.				£	s.	d.
Government Grant in aid of Printing				100	0	0
Subscriptions :—						
Current, 123 at £1/1/- ...	£129	3	0			
Arrears, 8 at £1/1/-	8	8	0			
Advance, 12 at £1/1/- ...	12	12	0			
				150	3	0
Payments for use of Society's Room				14	0	0
Sale of Publications				28	7	6
Miscellaneous				24	4	7
				£316	15	1
Dr. Balance, 1920				50	6	6
				£367	1	7

PAYMENTS.				£	s.	d.
Balance brought forward				50	18	5
Salaries				33	15	0
Papers and Proceedings :—						
1919 (Part)	£65	10	6			
1920 (Part)	128	10	2			
				194	0	8
Expenses of Meetings				21	3	3
Library				9	12	11
Light and Fuel				2	7	9
Lantern and Operator				8	16	6
Postages and Petty Cash				9	9	8
Miscellaneous...				35	14	8
Bank Charges, etc.				1	2	9
				£367	1	7

MORTON ALLPORT MEMORIAL FUND ACCOUNT,* 1920.

RECEIPTS.		£ s. d.	PAYMENTS.	£ s. d.
Balance brought forward 1st Jan., 1920		49 14 3	Mathew's Birds of Australia (Part)	42 2 7
Interest received from Perpetual Trustee Co.—			International Catalogue of Scientific Literature	
5 per cent. on £200 War Loan	£10 0 0		(additional volumes)...	27 1 6
Less Trustee Co. Commission ...	0 5 0			
		9 15 0		
		£59 9 3		
Dr. Balance, 1920		9 14 10		
		£69 4 1		£69 4 1

* £200 was raised by Public Subscription in 1878 to establish a Memorial to the late Morton Allport. The Fund was invested in the name of the Perpetual Trustees, Executors, and Agency Co. of Tasmania Ltd., and the income is used for the purchase of Books for the Library of the Society.

I have compared the Receipts Book, Vouchers, and Bank Book with Items particularised in the Cash Book, and found them to be correct.

11th January, 1921. R. A. BLACK, Hon. Auditor.

L. RODWAY, Hon. Treasurer.
CLIVE LORD, Secretary.

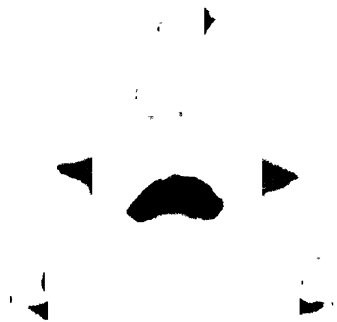
7th January, 1921.

INDEX.

Titles of Papers, and New Genera and Species in **Heavy Type.**
Synonyms in *Italic.*

DOLPHINS SURF.

ATLAS.



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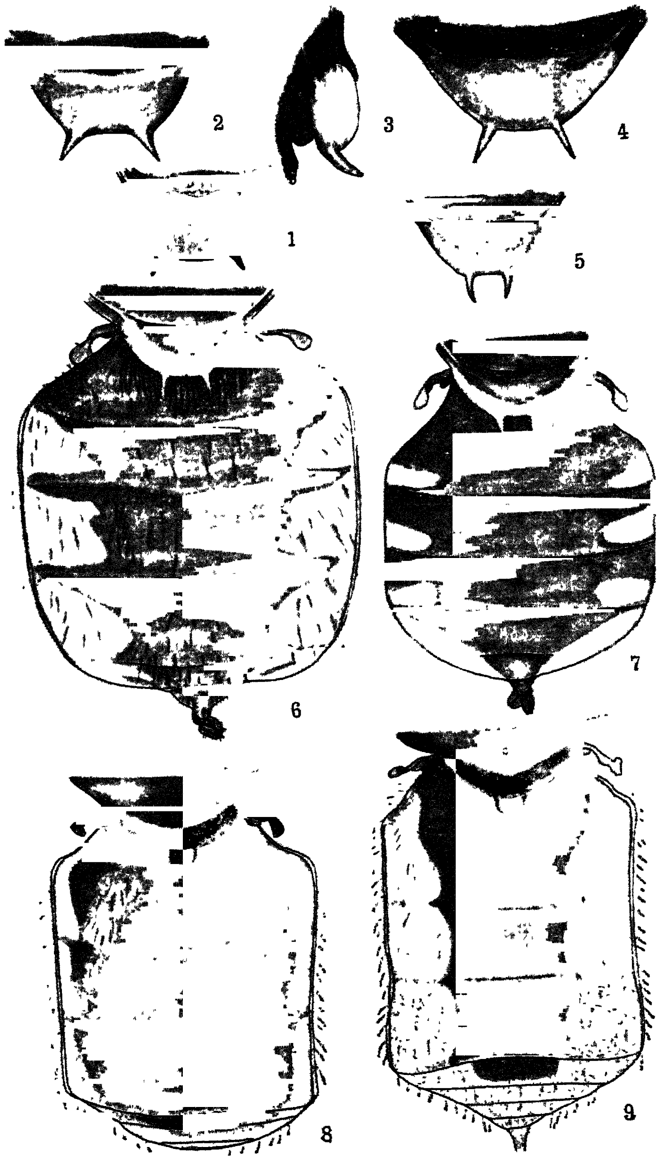
NOTOTHERIUM MITCHELLI.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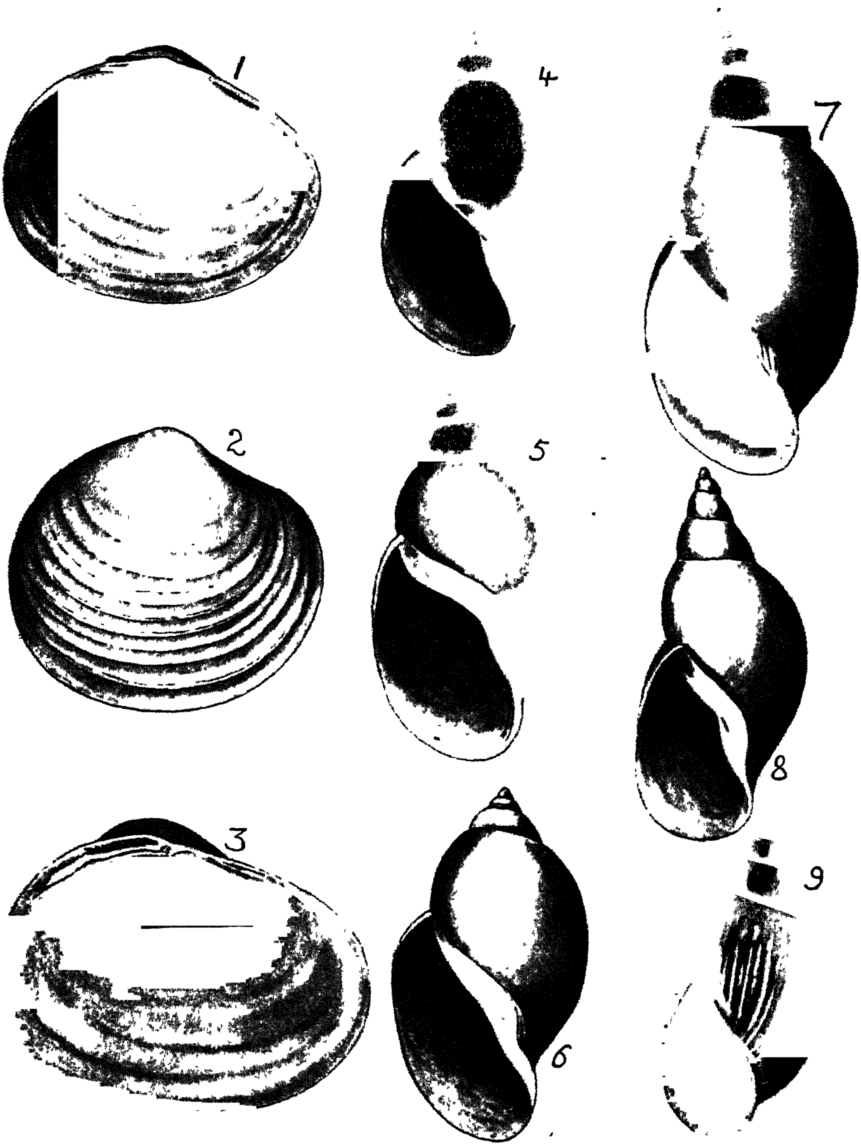
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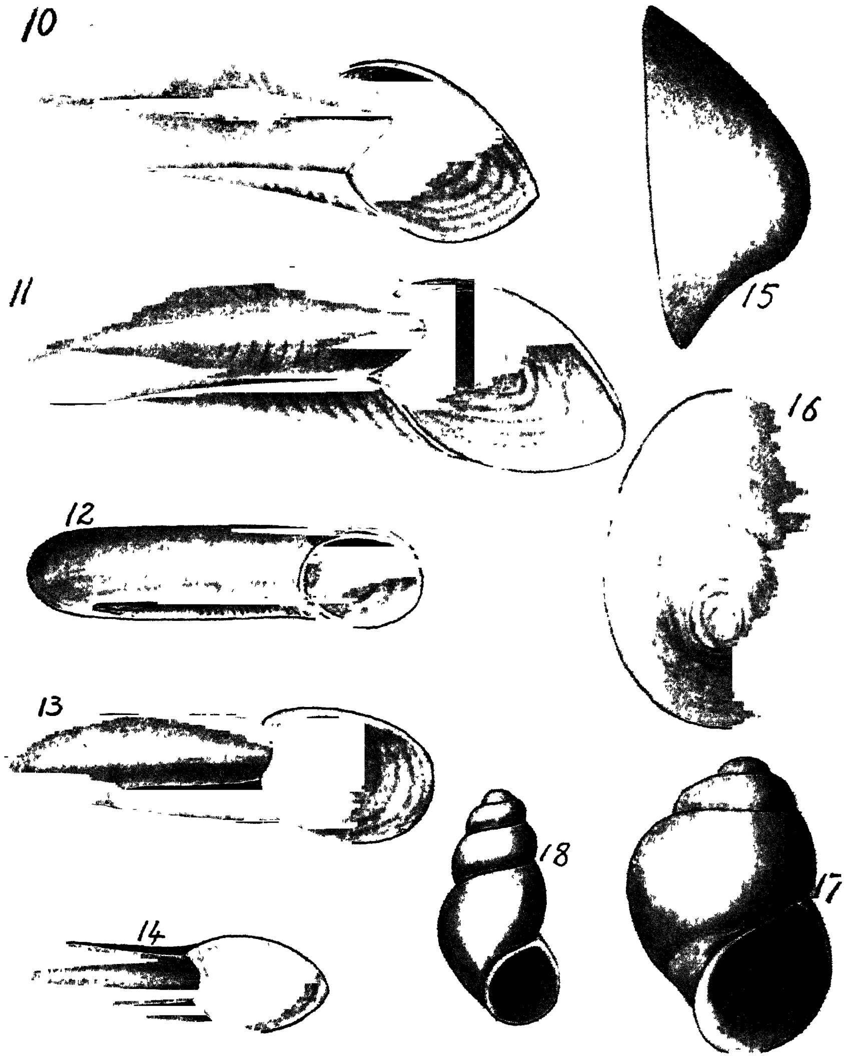
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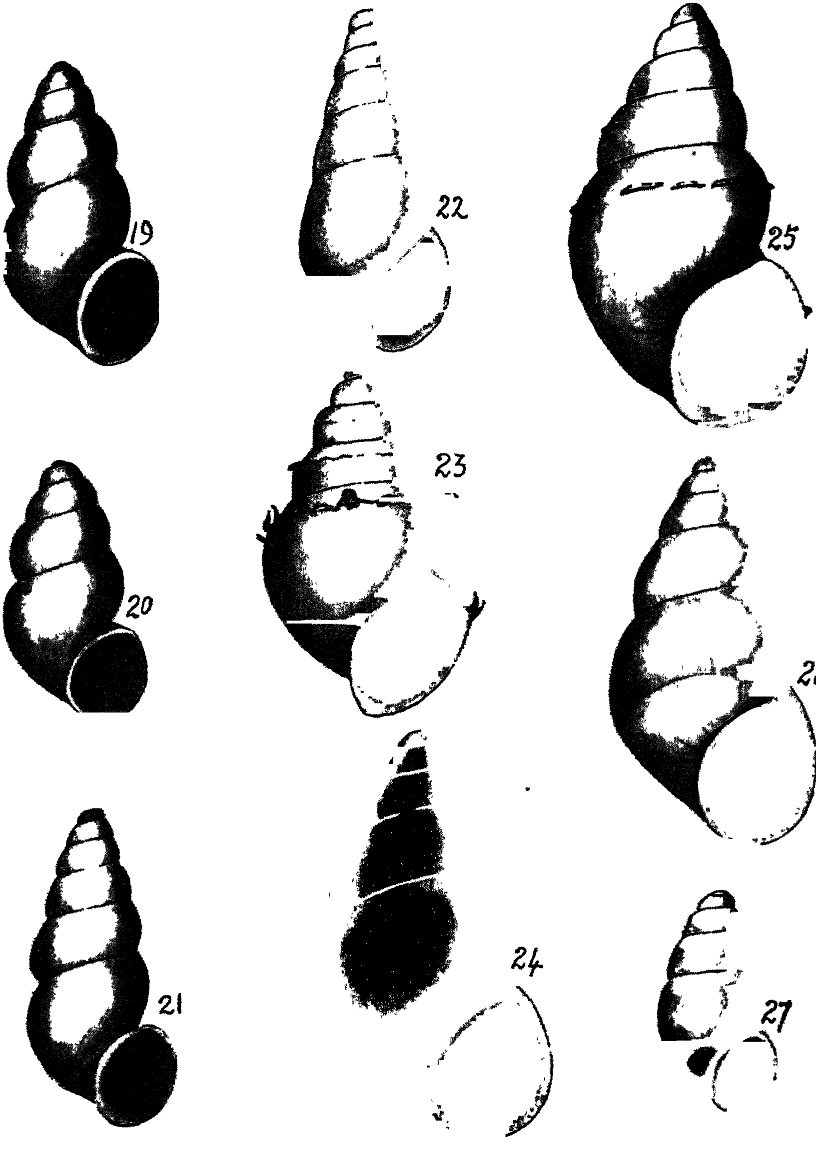
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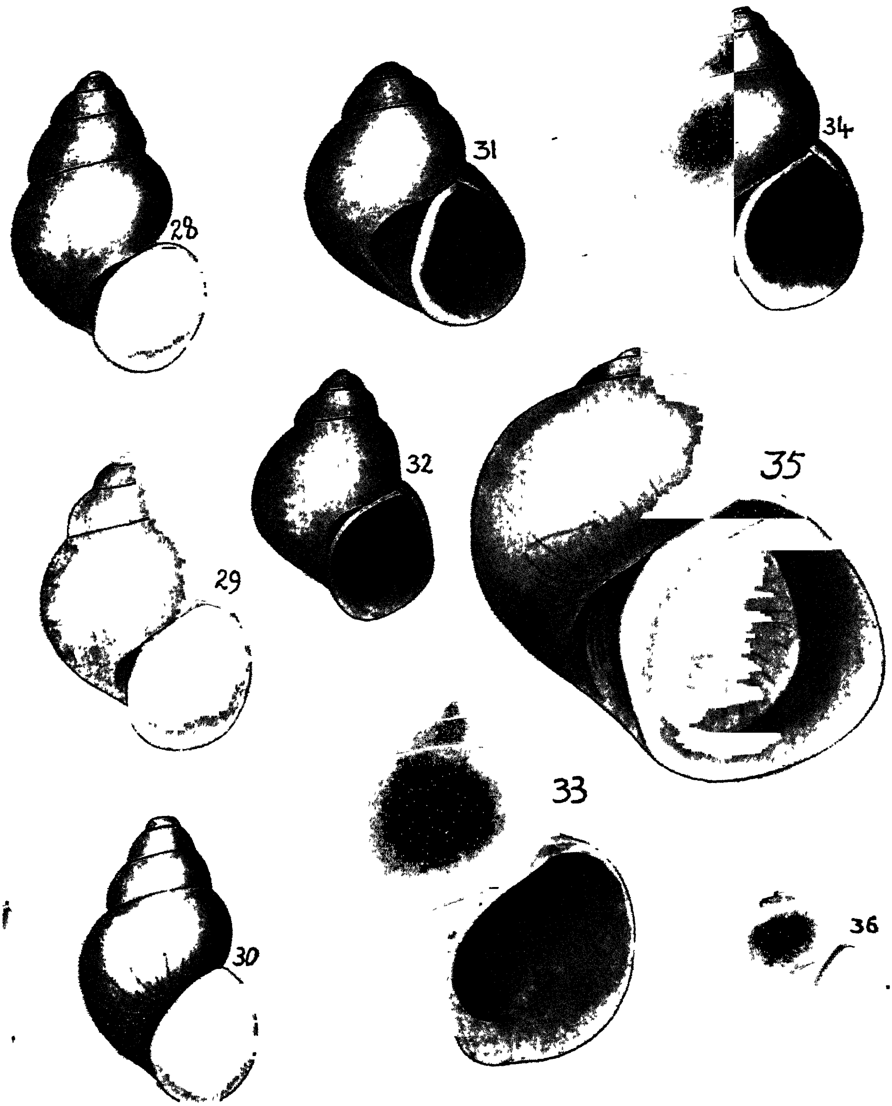
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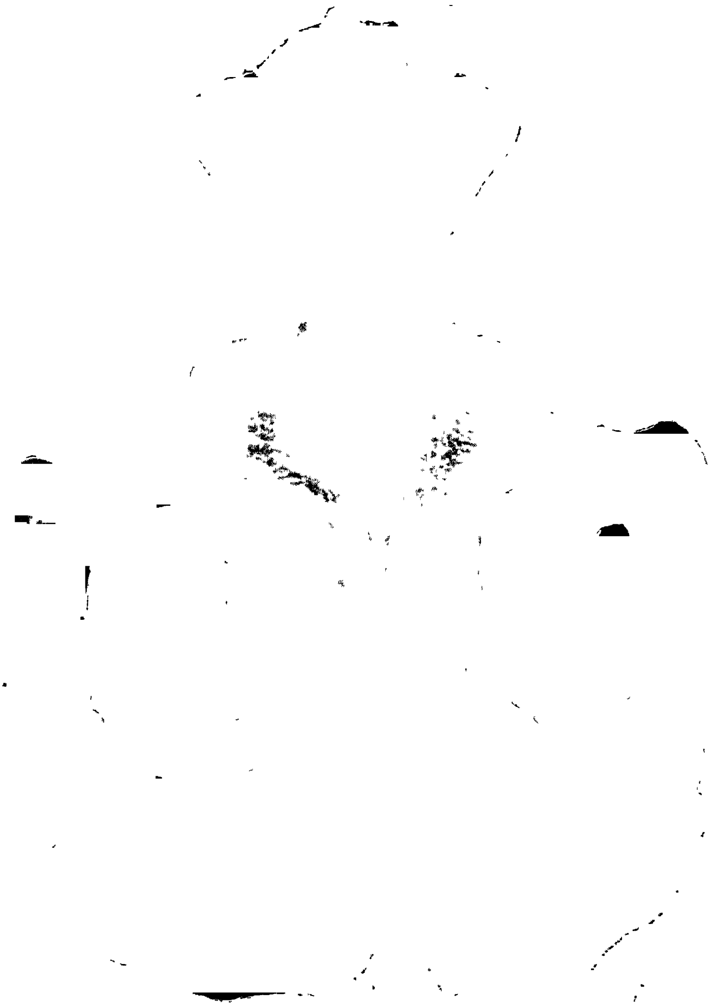

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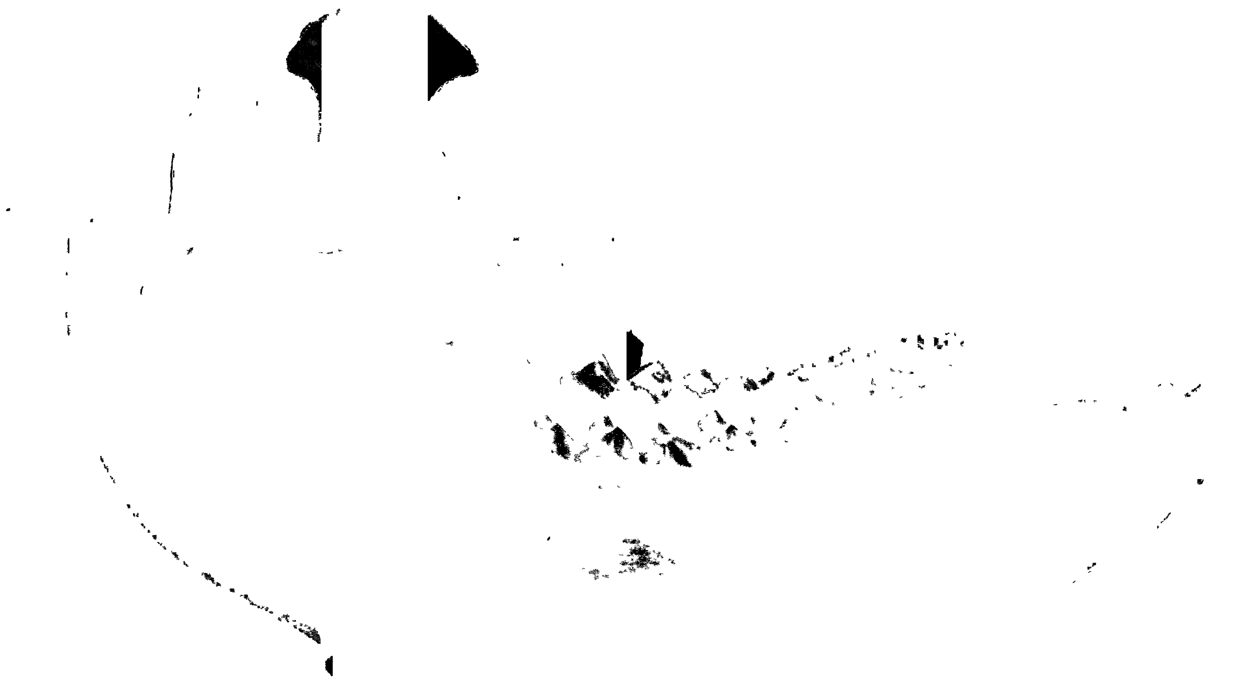

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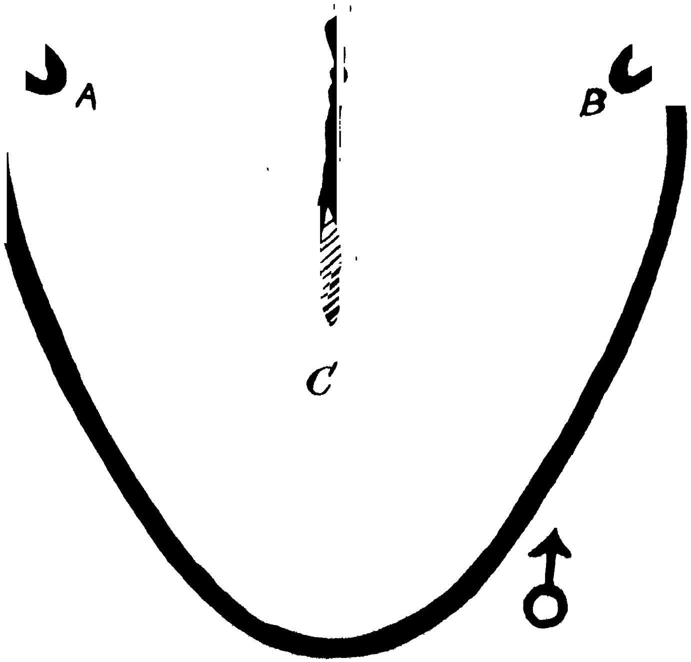

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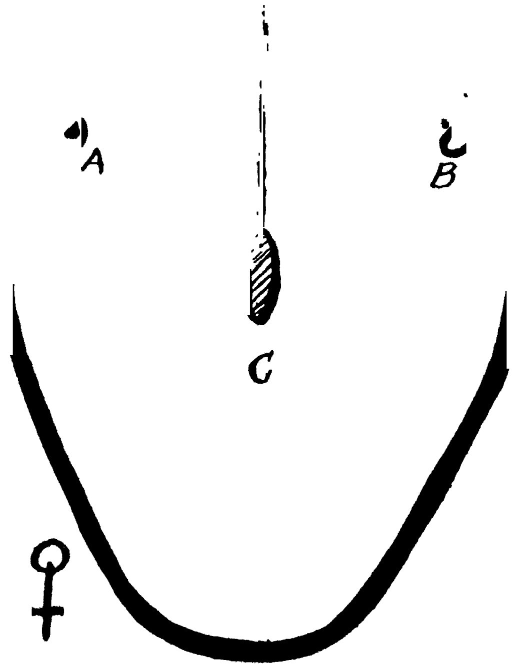

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NOTOTHERIUM MITCHELLI.—MANUS.

ROYAL SOCIETY
OF
TASMANIA

PAPERS & PROCEEDINGS

OF THE

ROYAL SOCIETY OF TASMANIA

FOR THE YEAR

1921

(With 30 Plates and 5 Text Figures)

ISSUED 28th FEBRUARY, 1922

PUBLISHED BY THE SOCIETY

The Tasmanian Museum, Argyle Street, Hobart
1922

Price: Ten Shillings

The responsibility of the statements and opinions in the following papers and discussions rests with the individual authors and speakers; the Society merely places them on record.

ROYAL SOCIETY OF TASMANIA

The Royal Society of Tasmania was founded on the 14th October, 1843, by His Excellency Sir John Eardley Eardley Wilmot, Lieutenant Governor of Van Diemen's Land, as "The Botanical and Horticultural Society of Van Diemen's Land." The Botanical Gardens in the Queen's Domain, near Hobart, were shortly afterwards placed under its management, and a grant of £400 a year towards their maintenance was made by the Government. In 1844, His Excellency announced to the Society that Her Majesty the Queen had signified her consent to become its patron; and that its designation should thenceforward be "The Royal Society of Van Diemen's Land for Horticulture, Botany, and the Advancement of Science."

In 1848 the Society established the Tasmanian Museum; and in 1849 it commenced the publication of its "Papers and Proceedings."

In 1854 the Legislative Council of Tasmania by "The Royal Society Act" made provision for vesting the property of the Society in trustees, and for other matters connected with the management of its affairs.

In 1855 the name of the Colony was changed to Tasmania, and the Society then became "The Royal Society of Tasmania for Horticulture, Botany, and the Advancement of Science."

In 1860 a piece of ground at the corner of Argyle and Macquarie streets, Hobart, was given by the Crown to the Society as a site for a Museum, and a grant of £3,000 was made for the erection of a building. The Society contributed £1,800 towards the cost, and the new Museum was finished in 1862.

In 1885 the Society gave back to the Crown the Botanical Gardens and the Museum, which, with the collections of the Museum, were vested in a body of trustees, of whom six are chosen from the Society. In consideration of the services it had rendered in the promotion of science, and in the formation and management of the Museum and Gardens, the right was reserved to the Society to have exclusive possession of sufficient and convenient rooms in the Museum, for the safe custody of its Library, and for its meetings, and for all other purposes connected with it.

In 1911 the Parliament of Tasmania, by "The Royal Society Act, 1911," created the Society a body corporate by the name of "The Royal Society of Tasmania," with perpetual succession.

The object of the Society is declared by its Rules to be "the advancement of knowledge."

His Majesty the King is Patron of the Society; and His Excellency the Governor of Tasmania is President.

ROYAL SOCIETY OF TASMANIA

PAPERS AND PROCEEDINGS, 1921

CONTENTS

PAPERS

OF THE

ROYAL SOCIETY OF TASMANIA

1921

NOTOTHERIA AND ALLIED ANIMALS—

A REJOINDER.

By

H. H. SCOTT, Curator Launceston Museum,

and

CLIVE E. LORD, Curator Tasmanian Museum.

Plates I.-III.

(Read 14th March, 1921.)

Before presenting to the Royal Society of Tasmania our notes upon the extinct Marsupial Rhinoceros, *Nototherium mitchelli,* (1) we cast them into such a form as to embrace extreme osteological details upon the one hand, and the widest taxonomical scope upon the other. This latter item, in fact, had its entire origin in the circumstances incidental to the super-imposition of the Rhinoceros trend upon the more or less generalised Marsupial races of geological periods long since past. Any criticism of our work or methods should therefore, in justice, take note of this duality, or to descend to details—deductions made from the wide scope of the trend should not be quoted in terms of that man-made taxonomy that is enthralled within the iron bands of genus, species, and variety. Again, to quote backwards from the living—and largely fixed—marsupials of to-day, to plastic, rapidly evolving generalised types, is to throw ourselves open to contradiction by the very next discovery that fortune places at our disposal. Accordingly, we used considerable caution in this respect, but, as it now appears, stand charged with an under-estimation of the values of the evidence yielded by a study of the Nototherian and modern marsupial premolars. (1920, pp. 13, 17, and 76.)

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(1) Pap. and Proc. Roy. Soc. Tas. 1920.

We therefore desire to add the present note to our previous papers in order to reply to certain remarks made by Mr. Heber Longman in his recent interesting contribution to the memoirs of the Queensland Museum, (2) on *Euryzygoma dunense*. (1920, p. 65.)

The extent to which generalisation obtained among Nototherian animals can only be appreciated by those who have for some reason or other paid special attention to the matter, and, therefore, we must be pardoned for giving in detail the following item of cranial morphology.

The zygomatic arch of a Nototherium such as that of *Nototherium tasmanicum* leaves the occiput under conditions that are not exactly repeated by either *Macropus* (Kangaroos), *Phascolomys* (Wombats), or *Phascolarctus* (Native Bears), but upon the whole they are those of *Macropus*. It descends into the orbit at a vertical line at least 50 mm. in advance of the premasseter process (not so in *N. mitchelli*), while in the Kangaroo this process outwardly underprops the posterior third of the orbit. It does not reach it by 8 mm. in the Native Bear and 10 mm. in the Wombat. Owing to the heavy developed premasseter process the morphology of the orbit here departs from that of the Kangaroo, misses the Wombat outline, but with generic characteristics assumes in exaggeration that of the Native Bear, which it continues to follow with added closeness to the end of the skull, including the lateral incisors, but not the nasal regions. Here, then, in a few inches of space we have the characters of three modern animals in generalised association in the skull of a single Nototherium, and might we not then expect that equally generalised creatures of the same age should show intergrading dental characters that would render the strictest terms of modern classification untenable?

Our use of the word *Phascolonus* was intended to imply that the jaws called *Nototherium dunense* conformed even more strongly to the *Phascolonian* type than they did to the *Nototherian*. In other words we considered the Wombat characters so accentuated in this mandible that it would be eventually classified with a type more generalised than *Nototherium*, and one that more closely approached the common progenitor of gigantic Wombats and Nototheria. Others besides ourselves have found such a creature thinkable; for instance, the late Richard Lydekker wrote thus of the family *Nototheridæ*:—"This family connects *Phascolomyidæ* with the

(2) Heber A. Longman. A New Genus of Fossil Marsupials. Mem. Qld. Mus. Vol. VII., pt. II.

"*Diprotodontidæ*. . . . It is easy to see how the structure of "the cheek teeth could pass into that of the *Phascolomyidæ;* "and it is not improbable that the two families may have "diverged from a common ancestor." (3) (1887, Vol. 5.)

That was our thought at the time of writing, and Mr. Longman's association of these jaws, almost immediately afterwards, with a more aberrant type of cranium than anything that had hitherto come to light, shows that our diagnosis was not misplaced.

Anybody who will carefully read our notes cannot fail to see how highly we estimated De Vis' work, and we regret to stand charged with any unfairness to him. We, therefore, take the first opportunity of saying that nothing was farther from our thoughts. Our general perusal of De Vis' works left the definite impression upon our minds that he looked to *Sceparnodon* to clear up some outstanding puzzles in regard to these generalised creatures, of which (as the future may yet prove) he visualised at least eight groups. In effect our reference simply meant this—*Sceparnodon*, having been shown by Stirling to be a synonym of *Phascolonus*, was eliminated *ipso facto* as a possible generalised animal, and this, in our opinion, left its generalised connection to the Wombat stirp pure and simple. Unfortunately (so hard is it to kill "genus," "species," and "variety"), the word "genus" crept in here, although the wider sense of the word is quite manifest when the sentence enclosing it is taken in conjunction with the full context.

Mr. Longman's criticism therefore pivots upon the single word "genus." Nature never produced animals ready made to genus, species, or variety, although she may have produced them in groups, and we yet hope to see these Nototherian groups with their sex, age, and individual variations clearly defined.

As, however, this was not a *fait accompli* when our notes were in course of compilation, and very much printer's ink had already been used over the dentition by those who had gone before us, we decided to seek the effects produced by the super-imposition of the Rhinoceros trend upon this section of the *Marsupialia*, rather than re-list the variation of the premolars;. some of which mutations are dangerously close to the morphological minutiæ inseparable from diphyodont succession. That any marsupial group should have taken on the Rhinoceros trend would, in the fact itself, introduce

(3) Lydekker. Cat. Fossil Mammalia, Brit. Mus. Vol. 5, 1887.

an enormous element of variation, from which the teeth, in addition to the other parts of the skeleton, could hardly escape the process of remoulding, and in the absence of a complete series of such changes, even in one group of animals, quite apart from the sum total, we tentatively classified known material in terms of the most obvious trend characters. If all extinct creatures had first been classified in groups, and as knowledge increased genera and species had been eventually created within the groups, how much confusion would have been avoided!

All classification is man-made, and in essence chiefly intended to avoid ambiguity when the name of an animal is mentioned. Most of us admit this, and yet rise up in arms immediately we are asked to act upon our conviction. Accordingly, we did not expect a ready acceptance of our group taxonomy, yet nevertheless it is as sound as if we had called the White Rhinoceros of to-day "A large-horned Rhinoceros" and the Chittagong animal a "Small-horned Rhinoceros."

RECAPITULATION.

(1) We are convinced that the several groups of more or less generalised animals lived in the Australian Zoogeographical province and that the names *Diprotodon*, *Nototherium*, *Phascolonus*, *Euryzygoma*, etc., stand as outpost flags to a largely unexplored realm.

(2) That De Vis' estimate of seven or eight groups may yet prove to be feasible.

(3) That the most generalised groups have yet to be re-constructed.

(4) That in view of these facts it is better to seek the elucidation of the groups than it is to argue over the sub-divisions of such groups. Accordingly, we write, and always have written, in that spirit, and without any desire to under-estimate the works of others.

EXPLANATIONS OF PLATES.

Plate I.

Side view of the articulated skeleton of *Nototherium mitchelli*. The specimen, although not perfect in all details, shows, for the first time, the general outline of this animal.

NOTOTHERIUM MITCHELLI.

NOTOTHERIUM MITCHELLI.

SKULL OF NOTOTHERIUM MITCHELLI.

PLATE II.

This aspect shows the aggressive, bulldog-like character of the fighting *Nototherium.*

PLATE III.

This view is specially arranged to show the pugnacious type of skull incidental to the evolution of the Rhinoceros trend among the Marsupials.

LIST OF WORKS REFERRED TO.

Longman, Heber A., 1920.—A New Genus of Fossil Marsupials. Memoirs of the Queensland Museum, Vol. VII., Pt. II., pp. 65-80.

Lydekker, R., 1887.—British Museum Catalogue of Fossil Mammalia, Part V.

Scott, H. H., and Clive Lord, 1920.—Studies in Tasmanian Mammals. Papers and Proceedings of the Royal Society of Tasmania, 1920.

STUDIES IN TASMANIAN MAMMALS, LIVING AND EXTINCT.

Number IV.

THE CAVE DEPOSITS AT MOLE CREEK.

By

H. H. SCOTT, Curator, Launceston Museum,

and

CLIVE LORD, Curator, Tasmanian Museum.

(Read 13th June, 1921.)

Through the courtesy of the Director of the Tasmanian Government Tourist Bureau (Mr. E. T. Emmett), we have recently had the opportunity of visiting two of the caves at Mole Creek, and obtaining a number of specimens relating to the mammalian fauna of Tasmania. Higgins and Petterd (1883) drew attention to the osteological remains in these caves, and they were later noted by Johnston (1888). Very little attention appears to have been paid to this locality by subsequent investigators, and we, therefore, desire to submit this short preliminary note to the Society in the hope that further investigations will be made. In the near future we hope to obtain a second and deeper series of specimens, and then to transmit to the Society a paper dealing with the material in general. Until we obtain a longer and older series of specimens than we have at present, we prefer to treat the matter on very general lines.

The two caves visited were Baldock's Cave and King Solomon's Cave. In the latter there are many specimens. The more recent are quite free, but the older ones have become encrusted with a thick limestone stalactitic coating, or else have become completely covered. In some cases the floors of certain of the caverns are practically bone breccia. Careful research may yield much of interest, for it is not improbable that some remains of *Thylacoleo* should be in these caves, if that marsupial lion ever inhabited Tasmania. Considering the knowledge we have recently gained in relation to the habitats of *Nototherium*, there is no reason to exclude the possibility of *Thylacoleo* being found.

We have only had time to examine a small section of the caves mentioned, and that only in a very superficial manner. When we consider that the Mole Creek district is honey-

combed with limestone caves, and that only a few have been explored, and these only to a very limited extent, we can form some idea of the work that remains to be done in carrying out a systematic examination of the locality. Much information concerning the mammalian fauna of Tasmania is doubtless to be gained by an examination of the fossil remains in these caves, and our present note is merely to call attention to the need for this work to be carried out. In illustration of the possibilities for useful scientific research that these caves hold out to us, we may mention that during December, 1914, we induced Mr. E. C. Clarke, of Liena, to collect osteological specimens from such caves as were immediately available to him, with the following results:—

(1) From a mass of material—amounting in the total to two sack loads—we, after the laborious process of sorting and classifying, were able to show that the conditions obtaining in these caves in times past were similar to those of the great bone caves of England and France.

(2) That almost every animal living in Tasmania to-day was represented by osteological remains, in the upper strata of these limestone caverns.

(3) That such evidence as the collection yielded all tended to suggest that the Carnivorous marsupials had dragged the Herbivorous animals into the caves to feast upon their remains. In addition, the well-like openings of certain of the caves doubtless served as an effective trap, as any animals accidentally falling down these would have no hope of returning to the surface.

(4) The deepest strata investigated supplied evidence of a Wombat very closely akin to the Hairy-nosed Wombat of South Australia.

(5) Eye rings of an Owl showed that these birds found homes in the caves, and doubtless joined issue with the Carnivora in picking the bones.

Some caves on Flinders Islands were (at our suggestion) partly explored by Mr. Henwood in 1917, with the result that such evidence as the material yielded proved to be exactly similar data to that obtained at Mole Creek, and suggested a common date of deposition of the superficial strata.

As already said, the real problem of the future is to penetrate the upper layers of bone deposits, and seek for remains of the more ancient Pleistocene giants, and in this search any, or all, of the Mole Creek Caves may prove important sites.

LIST OF WORKS REFERRED TO.

Higgins and Petterd (1883).—Papers and Proceedings of the Royal Society of Tasmania, 1883.

Johnston, R. M. (1888).—Systematic Account of the Geology of Tasmania.

NEW SPECIES OF FOSSIL SHELLS FROM TABLE CAPE.

By W. L. May.

Plate IV.

(Read 13th June, 1921.)

The following nine species here described were mostly collected by the late E. D. Atkinson, so widely known for his interest in the Table Cape fossils, and who probably did more collecting in these beds than any other worker. Shortly before his lamented death he placed most of these specimens in my hands for description, he being particularly desirous that the two large *Turridæ* should be described and named. I have therefore felt it a duty devolving upon me to carry out my friend's wishes, to the best of my ability.

The five species of *Marginella* here described, together with the four already recorded, make up the goodly number of nine species of these interesting forms, and show that the genus was well represented in Tertiary times in our seas, as well as being so abundant in recent times. All the figures are drawn from the types, which will be presented to the Tasmanian Museum.

Marginella atkinsoni, Sp. nov.

Shell broadly fusiform, smooth, white and shining. Whorls four, much rounded; spire exsert, about one-third the length of the shell; broadly shouldered but tapering narrowly anteriorly. Aperture rather narrow; columella slightly concave, bearing four strong plaits, the anterior one being almost vertical, the second less so, the upper two very transverse, the highest of all being at right angles to the pillar. Outer lip curved, very heavily thickened, crenulated on the inner edge by about a dozen rather irregular denticles.

Long. 5, lat. 3 mill.

This species, which is common at Table Cape, is very similar to *M. wentworthi*, Ten.-Woods, but is a much broader shell, with rounder whorls, and a more curved, and far more heavily varixed outer lip.

Named after the late E. D. Atkinson.

Pl. IV., fig. 1.

Marginella corpulenta, Sp. nov.

Shell very broadly pyriform, with an elevated pyramidal spire and mammillated apex. Whorls four, well rounded;

very broadly shouldered. Aperture large; columella very convex above, excavate below, where it bears four rather thin plications, of which the anterior is almost vertical, the others being more transverse. Outer lip very rounded in outline much thickened, slightly corrugated within.

Long. 5, lat. 3.3 mill.

Table Cape, 2 examples.

Related to the last, but is a much broader shell, of different appearance, and lacks the strong toothing on the lip.

Pl. IV., fig. 2.

Marginella subquinquidens, Sp. nov.

Shell smooth, shining, broadly fusiform, with a prominent blunt topped spire. Whorls four, rounded; not shouldered above the aperture. Aperture rather narrow, widening towards the front. Columella nearly straight, bearing five plaits, which are massive and broad, and practically all on the same slant. The fourth plait varies in different individuals, from being nearly as strong as the others, to less and less prominence, until in some specimens it is absent; hence the name. Outer lip rather rounded, strongly thickened, smooth within.

Long. 5, lat. 3 mill.

Common at Table Cape.

Pl. IV., fig. 3.

Marginella rotunda, Sp. nov.

Shell very small, roundly pyriform, spire scarcely exserted. Aperture about as high as the shell, curved, narrow above, but widening towards the front, which is somewhat produced. Columella very roundly convex, with three moderate-sized teeth, and two or three minute denticles above. Outer lip moderately thickened, unarmed.

Long. 2.5, lat. 2 mill.

Table Cape, 3 specimens.

This may resemble in form *M. octoplicata*, Ten.-Woods, of which he gives no measurements, but it is separated from that species by its smooth outer lip.

Pl. IV., fig. 4.

Marginella altispira, Sp. nov.

Shell broadly fusiform, with a tall, blunt-topped spire. Whorls four, moderately rounded; the spire and aperture are

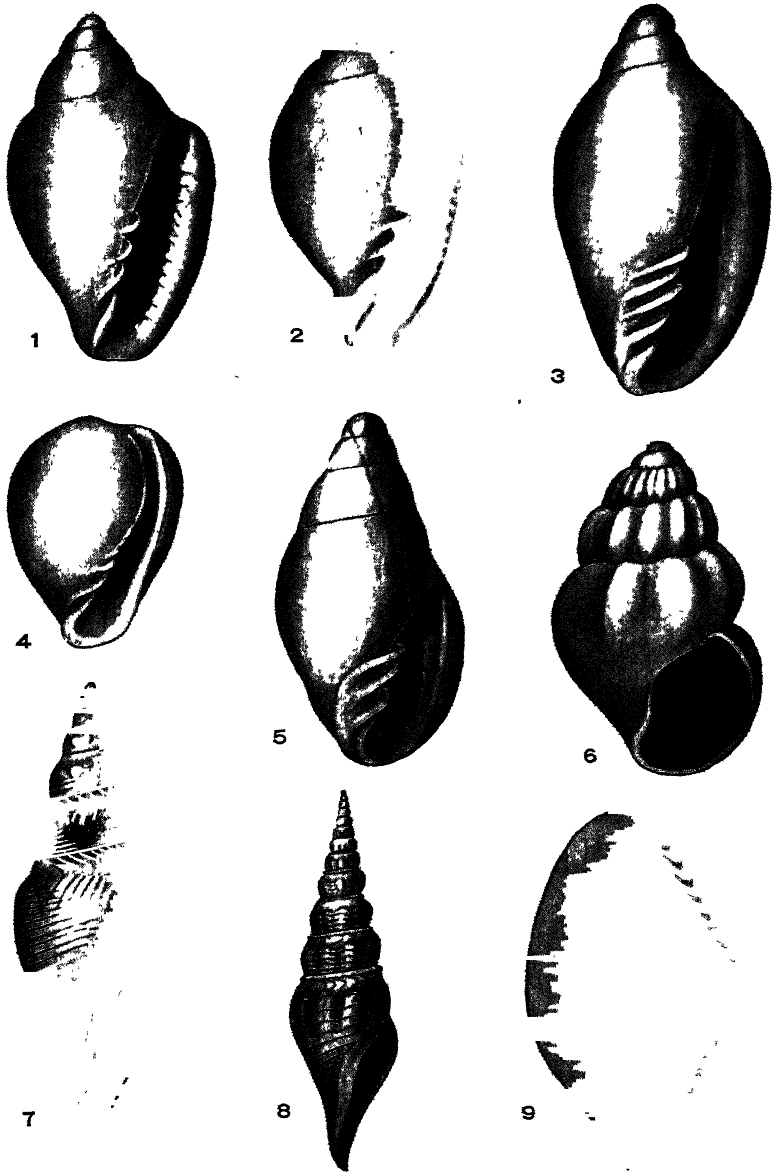


Fig. 1.
Marginella atkinsoni.
Fig. 4.
Marginella rotunda.
Fig. 7.
Turris conspicua.

Fig. 2.
Marginella corpulenta.
Fig. 5.
Marginella altispira.
Fig. 8.
Turris altispira.

Fig. 3.
Marginella subquinquidens.
Fig. 6.
Haurakia crassicosta.
Fig. 9.
Nuculana rhomboidea.

of about equal length. Aperture small; columella concave, bearing four strong teeth, which extend about two-thirds up the pillar, and extend well out on to the base of the shell; outer lip very massively thickened, much rounded, with a strong tubercle within, placed near the upper third.

Long. 5, lat. 3 mill.

Table Cape, several specimens.

Remarkable in the genus for its tall spire and small short aperture. It makes some approach to the recent *M. allporti*, Ten.-Woods.

Pl. IV., fig. 5.

Haurakia crassicosta, Sp. nov.

Shell minute, broadly turbinate. Whorls five, the two apical smooth and polished; suture well impressed. The first adult whorl has about 9 to 10 closely set axial ribs in a half turn; the second has 6 to 7 much stronger ribs; and the body whorl about 5 strong rounded ribs, separated by deep furrows of equal width; these ribs cease near the centre of the whorl, the base being quite smooth. Aperture roundly-oval; columella very convex.

Long. 2, lat. 1.5 mill.

Table Cape, 2 specimens.

This resembles *H. tateana*, Ten.-Woods, in size and general appearance, but has much fewer and stronger ribs.

Pl. IV., fig. 6.

Turris conspicua, Sp. nov.

Shell very large, fusiform, spire and aperture about equal. Whorls about eight, rounded; suture impressed. Aperture narrow. The sculpture indicates a fairly deep sinus immediately below the suture. The upper whorls are faintly coronate at the angle, and ridged by lines of growth; and are concentrically finely lirate all over.

Long. 83, lat. 24 mill., or 3¼ x 1 inches.

Table Cape, two examples.

This is a very fine conspicuous form, and must be extremely rare, as these were the only specimens taken by Mr. Atkinson during many years' collecting.

It would seem to approach the Turrid genus *Genota*.

Pl. IV., fig. 7.

Turris altispira, Sp. nov.

Shell narrowly fusiform, with a very high attenuate spire, which is nearly twice the length of the aperture. Whorls about 13, rounded, suture impressed, with a broad groove, or hollow immediately below it. The ornament consists of well developed axial ribs, about six on a half-turn; these are crossed on the lower half of the whorl by four spirals, which nodulate the ribs; the upper slope being nearly smooth, but showing the growth-lines of the sinus which occupied this position; the spiral liræ continue on the base. Aperture narrow, contracted anteriorly into a canal; outer lip imperfect.

Long. 28, lat. 9 mill.

Table Cape, two examples only.

Probably related generically to the last. Remarkable for its tall attenuate spire and small aperture.

Pl. IV., fig. 8.

Nuculana rhomboidea, Sp. nov.

Shell minute, smooth, white and shining, rhomboidal, rounded in front, narrowly produced behind into a short beak. Hinge line arcuate, bearing arrow-shaped teeth, strong on the anterior slope, but less so posteriorly.

Breadth 2, height 1.3 mill.

Table Cape, fairly common.

A very solid little shell, easily distinguished from associated species by its minute size, shape, and smooth polished exterior.

Pl. IV., fig. 9.

EXPLANATION OF PLATE IV.

Fig. 1. *Marginella atkinsoni.*

Fig. 2. *Marginella corpulenta.*

Fig. 3. *Marginella subquinquidens.*

Fig. 4. *Marginella rotunda.*

Fig. 5. *Marginella altispira.*

Fig. 6. *Haurakia crassicosta.*

Fig. 7. *Turris conspicua.*

Fig. 8. *Turris altispira.*

Fig. 9. *Nuculana rhomboidea.*

STUDIES IN TASMANIAN MAMMALS, LIVING AND EXTINCT.

Number V.

Zaglossus harrissoni, Sp. nov.

By

H. H. Scott, Curator of Launceston Museum,

and

Clive Lord, Curator of the Tasmanian Museum, Hobart.

Plate V.

(Read 13th June, 1921.)

Among some fossil bones recently recovered by Mr. K. M. Harrisson, from a swamp upon King Island, we have found evidence of a giant Ant Eater, that exceeded very considerably in point of size the modern *Monotreme*. The evidence is furnished to us in the form of a nearly perfect right femur, and a very small portion of the proximal end of a humerus. We fortunately possess several femora of the modern animals, collected by Mr. L. L. Waterhouse in January, 1916, during a visit to King Island upon Geological Survey Work, and are therefore enabled to make a direct comparison between the Pleistocene, and the more recent Monotremes of that locality. We are evidently dealing with a smaller animal than "*Zaglossus hacketti*," of Western Australia, since that animal was fully double the size of the modern Monotreme, in point of femoral and humeral length, in addition to an added robustness of the skeleton generally, but the extent to which it overtopped the Ant Eaters of modern King Island will be appreciated by the following table of measurements.

FEMUR OF GIANT.	FEMUR OF MODERN MONOTREME.
Total length=72 mm. (2 13-16 inches).	Total length=53 mm. (2⅛ inches).
Proximal width=30 mm. (1⅛ full).	Proximal width=18 mm. (¾ approx.).
Distal width=35 mm. (1⅜ inches).	Distal width=19 mm. (¾ full).
Thickness of shaft=10 mm. (7-16 full).	Thickness of shaft=5 mm. (3-16).

In life, this Pleistocene Ant Eater was, by estimation, some twenty-six inches in length (660 mm.) and more robust, in proportion, to the largest Tasmanian *Tachyglossus* of

to-day. In view of the fact that isolation from mainland climatic conditions almost certainly enabled the Pleistocene animals to survive, and vary, upon King Island and Tasmania, after their extinction elsewhere, we feel justified in segregating this animal to specific distinction, and have much pleasure in naming it after Mr. K. M. Harrisson, of Smithton, who has manifested such a keen interest in the extinct animals of Tasmania, and generously presented his specimens to our Museums.

DESCRIPTION OF THE FEMUR.

The shaft of the femur is nearly flat, as obtains in the *Monotremata* generally, and the head is devoid of an articular attachment for a ligamentum teres, thereby agreeing with mammals as high in the scale as the *Nototheria* from the same locality. The trochanter major is missing, but it evidently did little more than bound the epitrochanterian surface, since its muscular attachment functions are largely carried out by the extensive ridge extending for 35 mm. down the shaft. Both sides of the shaft indicate great muscular conditions, the popliteal fossa is enormous, its crescent shaped area taking the full mass of a large human thumb to fill it, when the latter is strongly pressed to the diaphysis. The rotular trochlea is 25 mm. wide, well marked, and curved only in the vertical direction. The intercondylar fossa is 10 mm. wide, and 9 mm. The lina aspera is similar to that of the modern animal, as also are the proportions existing between the internal and the external condyles.

A complete skeleton of one of these animals, obtained from a swamp that has undergone fewer mutations than the King Island lagoons appear to have suffered, would be a welcome addition to our knowledge, and for this desideratum we may yet turn to the Mowbray Swamp at Smithton, and meet with success.

The portion of the humerus is too fragmentary for detailed description or even photographic reproduction. The evidence relating to gigantic Monotremes is largely contained in the following archives:—

CLASSIFICATION AND NOMENCLATURE.

Ann. Record Science and Industry, 1876, Page clxxi., in which Gills' use of the name *Zaglossus* predates Gervais' term *Proechidna*.

Femur of
Tachyglossus aculeata
(Enlarged).

Femur of
Zaglossus harrissoni
(Scott and Lord, 13/6/1921).
(Enlarged).

Osteog. Monot. viv. et foss., Page 43, in which Gervais uses the term *Acanthoglossus.*

Bull. Soc. Zool. France, 1881, No. 6, Pages 267-270, in which Dubois uses the name *Bruijinia.*

CHIEFLY DESCRIPTIVE.

Krefft, 1868. Ann. Mag. Nat. Hist., Vol. I., Page 113.

Krefft, 1884. Phil. Trans., Page 273.

W. S. Dun, 1895. Rec. Geol. Surv., N.S. Wales, Vol. 4, Part 3, Page 121.

L. Glauert, F.G.S., 1914. Records of the W.A. Museum, Vol. I., Part 3, Pages 244-248, gives Bibliography, Taxonomy, and detailed description of *Zaglossus hacketti.*

DESCRIPTION OF PLATE V.

Femur of Giant Ant Eater, *Zaglossus harrissoni* (Scott and Lord, 13/6/1921), from the Pleistocene formation of King Island, contrasted with the femur of a sub-fossil specimen of *Tachyglossus aculeata,* from the sand blow at Cape Wickham, King Island, collected by L. L. Waterhouse, Assistant Government Geologist, 19th January, 1916.

A PRELIMINARY SKETCH OF THE GLACIAL REMAINS PRESERVED IN THE NATIONAL PARK OF TASMANIA.

By A. N. Lewis, *M.C.*

Plates VI.-XIV.

(Read 11th July, 1921.)

INTRODUCTORY REMARKS.

This paper is offered as a preliminary and very general sketch of the district described, upon which more detailed examinations of separate sections may be based. The author cannot at present offer a complete geology of the National Park of Tasmania. Its size, ruggedness, and general inaccessibility, aided by the usually inclement weather of the mountains, make the task difficult, and demand a far greater expenditure of time than has been available up to the present. Much of the Park is still unexplored, and parts were first visited that some of the information contained in this paper might be gleaned. But an outline description is urgently needed, firstly as a frame into which more detailed investigations may be fitted, secondly, for the information of visitors, who, in annually increasing numbers, spend holidays on the Park's highlands, and also as an assistance to the parties who are now inspecting this region in connection with water supply questions.

The author also offers the information as a small contribution to the Geology of Tasmania, information which, in the absence of local text books, it is hoped will be of assistance both to students and teachers. Tasmania is our home. It provides us with wonderful examples of every geological phenomenon. These are of living interest to us. Let us rather study them, and know our own home, than seek our geology from books published about distant countries describing objects that are mere names to us.

As far as can be ascertained, the glacial remains on the Mt. Field ranges have never been described. They do not appear to have been observed, or at least their existence recorded, before the proclamation of the area as a National Park. There is, therefore, no previous literature on the subject to which to refer.

AN OUTLINE SKETCH OF THE GEOLOGY OF THE NATIONAL PARK OF TASMANIA.

The National Park of Tasmania is located about 50 miles from Hobart, among the Mt. Field ranges, on the northern slope of the Russell Falls River, a tributary of the Derwent. It comprises some 38,500 acres of wild mountain tops and dense forests, and contains the most varied scenery within a day's trip of Hobart. The Park was originally set aside in an endeavour to preserve some native fauna and a little of the romantic virgin bush from the depredations of a misguided civilisation, but with the opening up of the area it has been discovered that there are contained within its boundaries geological features of considerable interest.

Topographically the Park is a portion of the very much dissected Central Plateau of Tasmania, itself cut off from the remainder of the plateau, and isolated by the valleys of the Derwent and the Russell Falls Rivers. The smaller plateau so formed is itself a dissected tableland. This tableland consists of diabase that intruded into the older strata of most of Tasmania during the Cretaceous period, and the general topography conforms to the outline of this diabase. Probably the area was raised to its present height in one uplift by this diabase, contemporaneously with the elevation of the Mt. Wellington Range to the south and the Central Plateau to the north. Any overlying rocks carried up by the intrusion have since been removed by erosion.

In the past the Mt. Field Range has been considered a portion of the Mt. Wellington Range. This appears to me to be stretching the term mountain range too far. The diabase is undoubtedly of the same age, but the Mt. Field Range is separated from the Mt. Wellington Range by the Tyenna Valley. This valley is not entirely waterworn. The West Coast rocks extend into it at an altitude of less than 1,000 feet, and Ordovician limestones circle round from the Florentine Valley to the Junee. Above these, large beds of Permo-Carboniferous and Trias-Jura sediments bound the western face of Mt. Field West, and the entire northern slope of the Tyenna Valley, and there is no surface connection between the diabase of Tyenna Peak and that of

Mt. Mueller. We are, therefore, bound to conclude that the diabase intrusion raised the country from Mueller to Styx to an elevation of 4,000 feet, and similarly raised the Mt. Field plateau, but left the valley of Tyenna-Westerway at an altitude of less than 1,000 feet above sea level.

From the Tyenna Valley, through which flows the Russell Falls (or Tyenna or Crooke) River, the edge of this diabase mass rises rapidly, attaining an altitude of 4,000 feet in a mile or so. The backbone of the range extends roughly east and west from Mt. Mawson, through Mt. Monash, and Seager's Look-Out, to Mt. Field East, to which the land rises steeply from the Tyenna Valley on the south. From Mt. Field East and Mt. Mawson two large parallel ranges stretch away slightly west of north, reaching to the southern edge of the Derwent Valley, about 10 miles farther north, and maintaining an elevation of over 3,000 feet. Between these runs the deep valley of the Broad River.

To the west of this system stands the third parallel chain of the Tyenna Peak—Mt. Field West Range, a western outlier from the main diabase mass, to which it is connected by K. Col. The wonderful escarpment on the west of this range, dropping nearly sheer to the Florentine Valley, 3,000 feet below, represents the western edge of the diabase upthrust in this part of Tasmania.

These three great mountain ridges show the form of the diabase intrusion. Sedimentary rock skirts the lower slopes of the mountains from Mt. Field East to Mt. Mawson. It then runs a mile or more up the valley of the Humboldt Creek, and back round the end of Tyenna Peak, and right across the western face of Mt. Field West. Undoubtedly, the intrusive diabase took the form we now see it in, and erosion has worn out the softer sedimentary rocks between the lines of intrusion, forming the valleys now existing. If any further proof were required that such was the case, and not that water has worn the valleys out of a plateau of solid diabase, we can find it in the Lake Hayes Valley, where the face of the valley is lined with sandstone.

Of course, erosion has affected the diabase mountain tops to a certain extent, but the great valley regions of the Park are caused by the absence of diabase there. The columnar cliffs so common near the tops of all the mountain ranges in this area probably represent the edges of laterally intruded sills of diabase.

Time has not allowed a detailed examination of the sedimentary rocks of the Park. Near the entrance, and extending for some distance up the Tyenna Valley, are beds of Permo-Carboniferous lime—and mud—stones. These are overlaid by over a thousand feet of sandstone in huge, compact beds, in which strata can be scarcely distinguished. From general observations, all these sandstones appear to be of the Trias-Jura age, similar to the Knocklofty series so well known in Southern Tasmania. These beds have been distinguished by Mr. Loftus Hills at the foot of Mt. Field West in the Florentine, but their age requires confirmation elsewhere.

The drainage is typical of the stage known as juvenile, and most of the streams are mere mountain torrents. During the Pleistocene times, the cycle of river erosion was interrupted by glaciers in the higher altitudes. These have widened many of the valleys and dammed them in places. forming lakes and causing the streams to meander over an almost level bed. The Upper Broad River has the appearance of being in the mature stage, but it is really cutting through a valley not of its own making, and from which it has not yet had time to remove the remains of the glacier. In a day's walk along this valley, the student can see every form of river erosion.

The glaciers which caused this, and the way they have moulded the topography of the plateau, it is now the main purpose of this paper to describe.

THE COURSE OF THE PLEISTOCENE GLACIERS.

At the same time as the western half of Tasmania was more or less under ice, and from the same cause, snowfields accumulated on the Mt. Field Plateau, and glaciers flowed a little way down the valleys. It is well known that the Pleistocene Ice Age was not of uniform coldness. During periods of milder climate the glaciers shrank towards the mountain tops, and in intervals of intense cold they pushed out down the valleys. Unfortunately, a glacier tends to erase all traces of earlier action by its latest flow, but still we can see to what point the glacier reached, and trace the stages of its final retreat.

During the period of maximum glaciation, a permanent snow cap covered the entire top of the Mt. Field Plateau, and

probably extended down the sides to an altitude of 3,000 feet. The great snowfields that accumulated on the more level portions of the highlands fed glaciers that pushed down the valleys.

The chief of these ice rivers flowed down the Broad River; one branch fed by the snowfields extending from Mt. Monash to Mt. Mawson pushed straight down the valley. It was soon joined by a second flow of equal size from Lake Seal Valley, fed by accumulations of snow on the ridges above that lake, and later by a third branch flowing down from Lake Newdegate to Lake Webster. Together, these pushed four or five miles farther down the valley of the Broad River, and during its prime the glacier must have been seven miles in length, and over half a mile wide, and 300 feet deep. It extended to a point 2,400 feet above sea-level, where it melted, and the water was carried off down the Broad River to the Derwent. In the track of this glacier we find the most extensive evidences of ice action to be found in the Park.

On each side of this considerable glacier existed a group of smaller ice-streams. To the east, growing from snowfields on Mt. Field East, Kangaroo Moor, and on the eastern side of Wombat Moor, a glacier flowed down the valley now occupied by Lake Fenton, breaking up at about 3,000 feet above sea-level, not far below the present shore of Lake Fenton, at about the six mile peg on the track from the entrance to the Park.

Farther to the east, under the slope of Mt. Field East, two other glaciers developed. The larger, flowing southeast, was responsible for Lake Nicholls and Lake Rayner, and the other flowed south-west over the present site of Beattie's Tarn. Neither of these reached much lower than 3,000 feet, and both were small, as they were situated on the eastern, and, therefore, the dry and warm, side of the ranges.

The western group comprised two glaciers of considerable extent flowing in opposite directions, one southward through the Belcher-Belton Valley, and the other north through the Hayes Valley. These were fed by the snow from the lofty crags that surrounded them. The Belcher-Belton glacier was a composite one, and flowed for about two miles down the valley of the Humboldt Creek to an altitude of about 2,900 feet. The other was only about

a mile in length, and reached to about the 3,000 feet level.

It must be borne in mind that the erosion of the various creeks working up their valleys may have destroyed traces of ice action lower down than the altitudes mentioned, but this cannot have happened to any great extent, as the erosion has had little effect on other glacial remains in other parts equally exposed, so short has been the time since the disappearance of these glaciers.

Up to the present, there have been found in this part of Tasmania no indications calculated to throw any light on the age of this glacial period, but the remains are of most recent age, and evidences elsewhere in Tasmania place the occurrence in the Pleistocene period. The glaciers in the National Park were contemporaneous with those elsewhere, and strong evidence to the contrary would have to be deduced to alter the settled opinion that these glaciers belong to the Pleistocene.

Unfortunately, the entire area affected by this agency is of diabase. This makes it impossible to observe different kinds of rock in the moraines or to guess where the materials came from. Also the diabase weathers too rapidly to retain any trace of striæ. This is also the case with very much harder rocks. "It must be borne in mind that weather-"ing agencies have been at work so long and disintegrational "forces so active, that all positive traces on the rock sur-"faces would have been destroyed in the case of such rock "as granite." (Waterhouse, 1916.) "The Conglomerate" (West Coast Series Conglomerates of the Cambrian system, one of the hardest of rocks) "does not possess the requisite "texture for the preservation of the striations which almost "invariably have been effaced by exposure to the weather." (Reid, 1918.) Perhaps glaciated pebbles that have been protected from weathering processes by clay or sand may yet be found in the National Park with signs of striations.

Time and weather have prevented a complete exploration of the National Park, and other regions of glaciation may yet be found, especially north of Mt. Field East, and between the valleys of the Broad River and Bunyip Creek, and even over the shoulder between Mt. Field West and the Florentine Peaks. There is still ample scope for the enthusiast. The author can only hope that this paper may be of some assistance.

DESCRIPTIVE ACCOUNT OF THE GLACIAL REMAINS.

I. THE BROAD RIVER VALLEY (See Plates VI. and VIII.)

(a) Below Lake Webster.

The whole seven miles of the Upper Broad River Valley is a typical glacial trough, most markedly U-shaped, straight, and devoid of spurs. The floor, averaging half a mile in width, is quite flat, and the sides, gently sloping at first, rise abruptly 500 feet in a slope that is often precipitous. At the top of these sides depressions and spurs have begun to appear, but these have been shorn off lower down.

Glacial remains can be traced over four miles below Lake Webster. In this distance, the floor of the valley is nearly level, dropping only 150 feet. It is covered with button-grass growing on a stiff clay, and crossed at intervals by definitely marked and easily visible moraines. The Broad River winds through these button-grass plains, and cuts through the moraines first on one side, then on the other, and where it does so it drops quickly in a succession of stony rapids, passing out again on to the flats hardly to drop at all until the next moraine is reached. The river has cut down in places to a depth of six feet below the surface of this plain, and there you can see what underlies the vegetation.

Evidently, the glacier deposited in its retreat the various moraines which have successively blocked the valley from side to side. Behind these dams, large, shallow lakes were once banked up. The glacier dropped the larger boulders, as it melted, in the spot where we now see them as moraines, while the water escaping from the melting ice carried the finer materials out into these lakes as silt, and formed great beds of clay and sand on their floors. Across the surface of the lakes floated blocks of the glacier as icebergs, and dropped stones and pebbles into the clay. A large volume of water was liberated as the glacier melted, and these lakes overflowed at the lowest side of the moraine. In time this overflow cut away the loosely knit material of the dam, and eventually drained the water from the lakes, leaving the peculiarly level beds of clay we now

see covered with button-grass. Lake Webster and the watery marsh half a mile lower down the valley are all that are now left of a line of at least five lakes. Each lake must have been at least 30 feet lower than its higher neighbour. Perhaps they did not exist contemporaneously.

By following the course of the Broad River, it can be seen that the present floor of the valley consists of a fine grained, almost greasy, clay, usually of a yellow ochre colour, but also varying from light yellow to brown. It is never red, and iron deposits do not appear to exist in it. Boulders measuring a few feet in diameter are common throughout this clay, more particularly on the edges. In some places it can be clearly seen that stones have been dropped into the sediment from ice by the bending of the layers of the clay immediately below them, and here and there stones can be seen that are standing up on edge in the clay. In some places there are thin but extensive layers of gravel, suggesting a change of conditions, such as a flood; in other places there are layers of water-worn flaked cobbles, suggesting a wind-swept beach. In a few spots there exist considerable beds of sand and fine conglomerate, which here and there has already solidified into a rock of some hardness. These, however, are only occasional in the lower reaches of the glacial valley, the clays predominating.

Nearer Lake Webster, sand, gravel, and more typical glacial till increases in proportion until the clays vanish at about the confluence of the Broad River and the outlet of Lake Webster.

The entire deposit shows the characteristic confusion of a glacial deposit, except perhaps, where the stream has recently accumulated piles of alluvial drift. These are few, and confined to the river bed, and no notice is to be taken of them when studying the glacial deposits.

From these beds of clay rise at intervals masses of morainal debris, in some cases stretching in thin belts right across the valley, and in others standing in groups promiscuously dotted about in the button-grass flats. These rise to any height up to twenty feet above the floor of the valley. They consist of a brown earth and gravel freely mixed with oblong slabs of diabase, and containing many boulders of all sizes, up to 10 feet in diameter. Rain has washed the lighter material off the top of these piles of boulder clay, and the larger rocks stand out predominantly,

but their entire section can be studied where the river has cut through any one of these banks.

These were formed where the glacier halted for an interval during its retreat, from the debris tumbled out of the melting ice. We see them to-day just as the rocks and finer materials fell in a heap off the end of the glacier. Owing to their elevation above the surrounding flats, they are well-drained, and trees, chiefly dwarfed swamp gums, cover them, giving a rough guide to their whereabouts.

Probably there existed a small moraine below the place where the glacial remains now appear to end, at the spot at which the Broad River turns from north-west to north, and drops into a narrow V-shaped water-worn gorge, as lacustrine clays continue below the last remaining moraine. Once past these glacial flats, the river drops rapidly, and so has greater cutting power. Perhaps in the future further traces of glacial moraines will be found on the side of this water-worn valley, but this is doubtful.

The lowest of the remaining moraines can be clearly distinguished by the belt of trees growing on it. It is not very clearly defined, rising some five feet above the button-grass plain above it, and about twenty feet above the lower flat below. It averages fifty yards in width.

The next two moraines up the valley in the direction of Lake Webster are most distinct. The northern one of the pair has two large erratics standing about 50 yards from its north-west corner. These blocks (see Pl. XIV., Fig. 3) are roughly square, and measure 10 feet by 15 feet, and are resting on the clay beds of the button-grass swamp. From this point upwards nearly to Lake Webster lateral moraines on both sides of the valley can be traced, although they only stand a few feet from the surrounding country, but are marked by many large boulders. Both these moraines rise some 15 feet from the button-grass on the upper side, and about 30 feet on the lower. They both stretch from one side of the valley to the other in a wonderfully straight line. The lower one averages 200 yards in width, while the upper of the pair, which is the best example of a moraine in the Park, is only about 20 yards in width.

From a spot about 2,000 yards below Lake Webster, and a little distance below the considerable marsh that lies some way below that lake, this country of definite moraines, separated by beds of lake-formed clay, gives place

Lake Webster and the Broad River Valley, National Park, Tasmania.

to a confused bed of glacial till, rising more quickly, and covering the whole floor of the valley. Evidently, here the glacier receded with an even movement, distributing its terminal moraine equally over an area of country extending up to Lake Webster.

(b) Lake Webster to Lake Seal, Including the Tarns.

(See Plates VI. and VII.)

From a point somewhere about the junction of the Broad River with the outlet from Lake Webster, up the valley to about level with the end of Lake Seal, it is difficult to trace any definite movements of the ice-river. The whole valley is strewn with accumulations of morainal material of unknown depth. The surface of the ground is rendered very uneven by lines of this moraine in every direction, and at all angles, and by the many boulders scattered over the surface of the till.

Lake Webster lies in a depression in this moraine. It is a shallow lake seldom exceeding 10 feet in depth, and overflowing over the lower slope of the morainal mass. The Broad River flows down the eastern side of the valley, and is slightly lower than the lake, from which it is separated by a considerable ridge of glacial till running parallel to the course of the river and the side of the lake.

Three ice streams met in the vicinity of Lake Webster to form the great Broad River glacier. From the amount of work done, it appears that the glacier that flowed down the Lake Seal Valley was the most considerable. Rising in the great cirque that stands at the head of Lake Seal, and fed by ice flows from the higher ridges behind, some of which excavated the tarns, it conformed to the curve of the valley where now Lake Seal lies, and flowing round the eastern foot of Mt. Bridges until it emerged into the Broad River Valley, where it was joined by a second ice river flowing straight down the valley from the snowfield on the ridge between Mt. Monash and Mt. Mawson. Together, these glaciers passed on for a short distance, till they were met by a smaller flow descending from Lake Newdegate, and the ridges beyond, and joining the main flow at the site where we now see Lake Webster. The jumbled nature of the morainal deposits in this area probably reflects the confusion which this junction of three great glaciers caused in their component ice flows.

On the east of Lake Webster there are ridges running parallel with the sides of the valley, which may be medial moraines formed on the larger glacier from the laterals of the tributaries. But the traces are too confused to allow certainty on this subject, and signs of the erosive effect of the volumes of water that escaped from the glacier and flowed over this newly-formed bed of till can be seen everywhere.

The great gorge running west from Lake Webster, half a mile into the hills, shows most typically the sculpturing work of the glacier. It is decidedly U-shaped, with sides rising 1,000 feet nearly sheer, and it finally ends in a perfect cirque over which the outlet from some of the tarns and Lake Newdegate falls in cascades hundreds of feet in height.

Passing from Lake Webster to Lake Seal, you rise 200 feet in under half a mile. The surface of this rise consists entirely of glacial till, which runs out in a ridge or series of ridges already mentioned lying between Lake Webster and Lake Seal. This rise is probably a great moraine blocking the Lake Seal Valley completely, making the floor of Lake Seal on approximately the same level as Lake Webster. This could only be verified by soundings, and if it is not the case, Lake Seal could only be a wonderful example of hanging and overdeepened valley, but this latter view is unlikely.

Following up the outlet of Lake Seal, just after leaving the shore of Lake Webster, you cross a large transverse ridge of morainal material, through which the stream from Lake Seal has cut, and behind which run tributary streams. Past several more ridges the ground rises abruptly to the shore of Lake Seal. This slope consists of glacial till containing boulders of all sizes, set in red or brown earth and gravel, the typical decomposition product of diabase. Huge boulders rest on the surface of this lying tilted at the angle of the slope, evidently toppled off the edge of the glacier, melting just above, at the present shore of the lake. The outlet of Lake Seal falls over this moraine in a series of pretty cascades, and has cut a small valley in the glacial till, but nowhere in its course can solid rock be seen. The glacier was not confined to the gully of this outlet, but spread at least 400 yards wide right across the valley of the lake, and thus swung round into the Broad River Valley.

Lake Webster, National Park, Tasmania.

Lake Seal lies in a long, deep valley, decidedly U-shaped, which is blocked by the moraine at the eastern end of the lake. The top of this stands 200 feet above Lake Webster, but has been much worn down near its junction with the solid rock of Mt. Bridges. Farther east it is at least another hundred feet higher. This as it stands represents the largest specimen of a moraine in the Park. The moraine bounds the eastern edge of the lake, and curves round the southern shore, abutting on to a ridge running down past Platypus Tarn from a shoulder of Mt. Mawson. The shore of the lake on this moraine is bordered by a beach of water-worn cobbles, testifying to the force of the waves churned up by the winter hurricanes.

On the Broad River, opposite the end of this lake, can be seen half a mile of diabase outcrops rising 100 feet abruptly from the river, but on the Lake Seal side these rocks are covered with glacial till of the moraine just discussed, and are invisible. It was here that the glacier turned north. The depth of ice must have been tremendous, perhaps 1,000 feet. One of the most useful pieces of investigation in the Park would be to ascertain the height on each side of Mt. Bridges to which the glacier extended, and to ascertain the depth of Lake Seal by a series of soundings.

The line of glacial till extends over the whole slope from the Broad River to Lake Seal, reaching its highest point some six hundred yards south-east of the lake, whence it drops sharply to the southward into the gully of an unnamed tributary of the Broad.

A spur bounds Lake Seal on the southern side, gradually rising until it becomes part of the configuration of Mt. Mawson. This doubtless has a core of solid diabase, although it is deeply overlaid with glacial till. Along this ridge south of the lake, and parallel to the shore, run lines and ridges of this morainal material, perhaps representing lines of lateral moraines, but more probably ridges caused by lateral pressure of the ice. Some of the hollows between them contain ponds. Some of these hollows may have been formed by the imprisoning of large masses of ice in the moraine, the melting of which has caused the surface of the ground to sink. Among these ridges lie whole lines of huge boulders, many exceeding 20 feet in every measurement, and often piled on top of each other. Nowhere in the Park are there finer examples of erratics. In one place

the author saw two stones measuring 6 feet by 2 feet sticking on their ends out of the ground at different angles, and balanced across them lay a flat boulder, with a diameter of about 6 feet and a thickness of 1 foot. These deposits descend to the shore of Lake Seal, 200 feet below, and it is impossible to tell the depth of the deposit on this side, but on the edge of the Broad River Valley they soon disappear. They extend westward beyond Platypus Tarn, which lies in a hollow in this till.

From the centre of this ridge the morainal deposits curve round the top of the steep gully immediately to the south, and run past Eagle Tarn to the eastern shore of Lake Dobson. They appear to keep the same level at which we saw them on the ridge, not stretching far down the gully, and they do not extend far up the slopes of Mt. Mawson.

At the western end of Lake Seal there can be seen a most perfect specimen. of the glacial phenomenon known as a cirque. The glacier has eaten the foot of the hill away until the lake now ends in a wall 1,000 feet high, consisting of a series of rugged cliffs. The glacier has cut farther in to the north-west corner, and here formed a smaller cirque within the greater feature, making, indeed, a nail-shaped valley, a common feature in glaciated country.

The ice fed by the snow on the ridge above the tarns flowed in a sheet down the slope until it hit the ridge on which the tarns are now to be seen, which appears to run right round the eastern face of Mt. Mawson, a common feature on diabase mountains. Here its pace was checked, but it pushed on, until divided by the shoulder of Mt. Bridges, one half dropped over into the Lake Seal cirque, and the other into the cirque at the head of the valley leading to Lake Webster.

Where it hit the ledge of rock in its descent it ground great basins out of the solid rock, and it polished and rounded the outer portion of the ledge. In these rock basins water has accumulated which we now know as the six tarns, and between them and the edge of the two cirques—only a matter of fifty yards in the case of Robert Tarn—the diabase has been rounded and smoothed into waves of *roches moutonnees*, very distinct towards the southern end of the line of tarns. Many huge erratics stand on these and lie scattered over the country side, and towards Lake Newdegate there are considerable deposits of morainal material.

The size of these cirques has probably been increased by later action of frost, but undoubtedly the ice is responsible for the outline of this rugged stretch of country. Lateral expansion of the Lake Seal glacier, and the upward movement of its load as it swung round Mt. Bridges, also had something to do with the forming of its wonderful valley.

(c) The Head of the Broad River Valley.

Returning to the third branch of the main glacier, the one flowing straight down the trough of the Broad River. To the east of Lake Webster the river now flows on the east of the lines of ridges of glacial till already described, and for which the Lake Seal glacier was probably responsible. Shortly after passing the level of the end of Lake Webster, the glacial deposits in the actual valley of the Broad disappear, and within the general U-shaped valley the river runs for over half a mile down a typical waterworn gully over a series of pretty cascades. On both sides of this gully native diabase outcrops, and no signs of glaciation exist in the bed of the creek or further east, although a mile to the west, and 400 feet up the side of Mt. Mawson, we see the ridge of glacial till already mentioned, and glacial deposits abound above this gully as below. Evidently here, with a more abrupt slope in the floor of the glacial valley, the river has had more cutting power, and has cut a small valley of its own out of the floor of the larger valley, a floor probably largely composed of loose materials, and cut by the considerable flow of water escaping from the melting glacier, thus giving us an example of a valley within a valley. It does not appear reasonable to suppose that the glacier never pushed down over this section of the valley, and that the glacier lower down came entirely from the Lake Seal Valley, but rather that all traces just here have been removed by subsequent water action.

Once this short stretch is passed, the Broad River Valley assumes again an appearance somewhat similar to that below Lake Webster. But here the bottom of the valley is not so flat nor so wide as in the lower reaches, and is clearly the work of a smaller ice-river. The whole floor is covered with till consisting of earth, a quantity of clay, and a high proportion of boulders, especially towards the sides. These erratics increase in size and frequency until the Broad bends west to its source in Lake Dobson.

Just beyond this bend is a large bed of ice-borne erratics lying so thickly as to resemble a "ploughed field" of a mountain top rather than the bottom of a wide valley. The head of the glacier rested on the ridge connecting Mt. Monash to Mt. Mawson, where it has developed a broad but shallow and "young" cirque. This valley head is shaped somewhat like a nail head, too.

Lake Dobson lies in the western side of the head of the Broad River Valley. It is a shallow sheet, lying behind a slight moraine, which its outlet has cut through in a deep channel. To the east of the lake rises a high ridge completely covered by, if not entirely composed of, glacial till, which circles west past Eagle Tarn, and then east, joining the ridge south of Lake Seal, already described. The lateral creases are continued across this ridge, especially in the vicinity of Eagle Tarn, the outlet of which, cutting through several ridges, drains through a pretty gully to Lake Dobson. This whole ridge, with that nearer Lake Seal, appears to be a great pressure ridge formed in the V between the Broad River Valley glacier and the Lake Seal Valley glacier, and was doubtless largely formed by lateral pressure from both great flows.

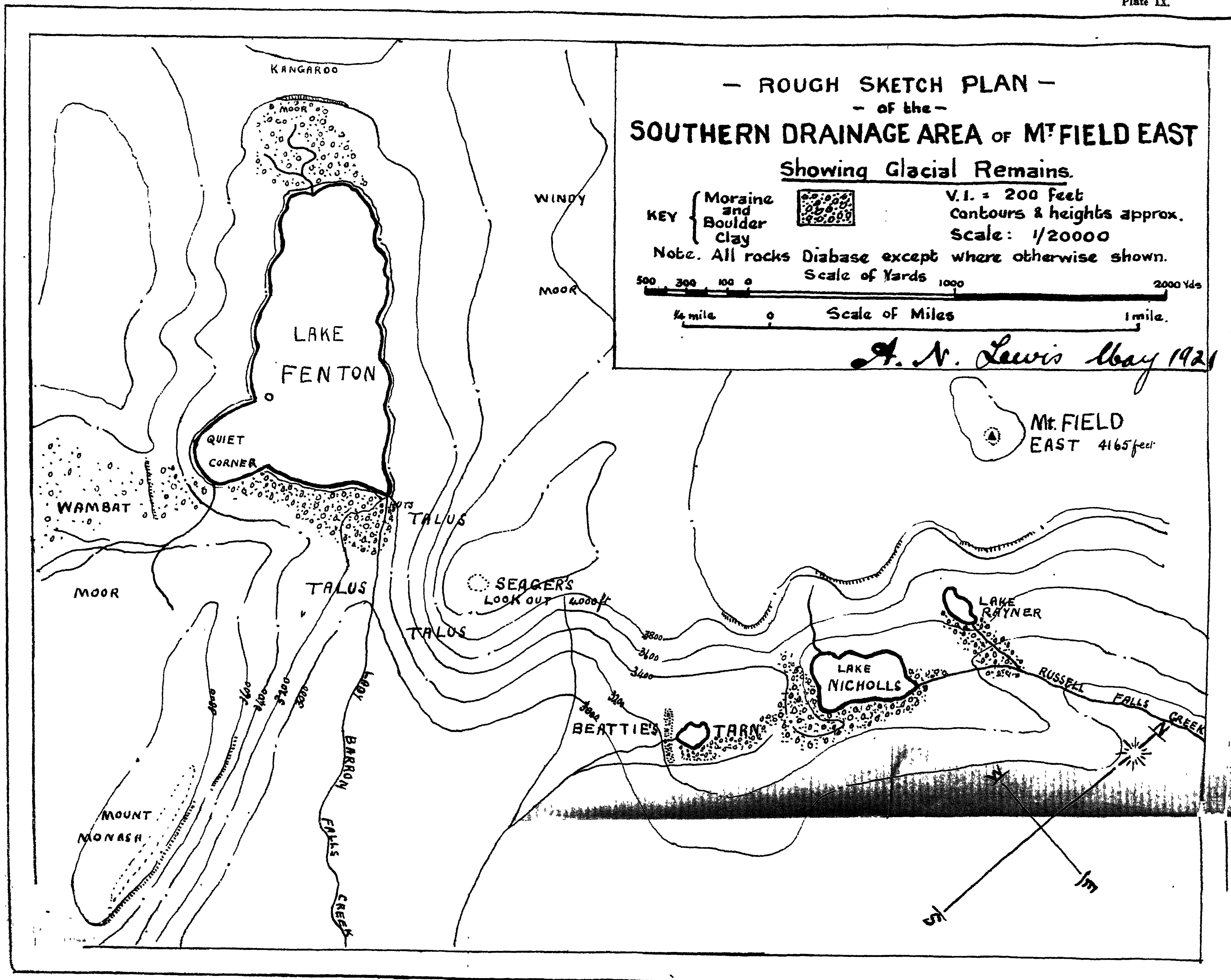
The moraine that dams up Lake Dobson, and the deposits that run from there a few hundred yards into the Broad River Valley, appear to be the work of the last phase of the glaciers, and to have been caused by a small flow from the slopes of Mt. Mawson.

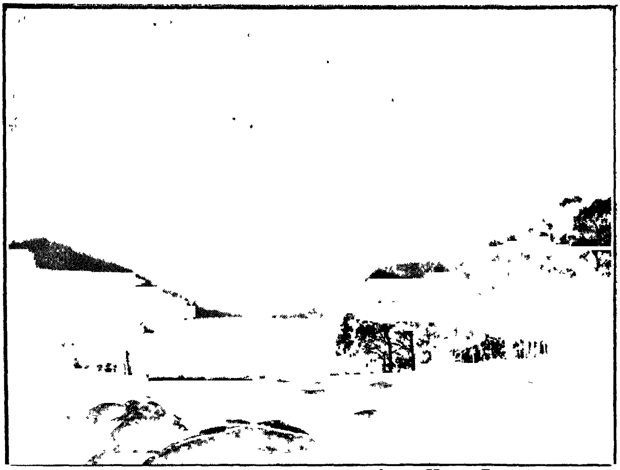
This whole valley of the Broad River can be traversed in an easy day's walk from Lake Fenton, and it would be difficult to imagine a locality of equal size that can provide such a series of points of interest to a student of nature or of pleasure to the picnicker.

II. THE EASTERN GLACIAL GROUP.—(See Plates IX. and X.).

(a) The Lake Fenton Valley.

To-day the country east of the Broad River Valley is drier, and the climate milder than the country farther west, and we may presume that during the ice age this condition prevailed in proportion So we see few glaciers on the eastern slopes of the mountains. Also the snowfields had far less area on which to accumulate, and the absence


- ROUGH SKETCH PLAN -
- of the -
SOUTHERN DRAINAGE AREA of Mt FIELD EAST
Showing Glacial Remains.
KEY
Moraine and Boulder Clay
V.I. = 200 feet
Contours & heights approx.
Scale: 1/20000
Note. All rocks Diabase except where otherwise shown.
Scale of Yards
500 300 100 0 1000 2000 Yds
Scale of Miles
¼ mile 0 1 mile.
A. N. Lewis May 1921
KANGAROO
MOOR
WINDY
MOOR
LAKE FENTON
QUIET CORNER
WAMBAT
MOOR
TALUS
TALUS
TALUS
SEAGER'S LOOK OUT
4000 ft
3800
3600
3400
3200
3000
BEATTIE'S TARN
LAKE NICHOLLS
LAKE RAYNER
RUSSELL FALLS CREEK
LADY BARRON FALLS CREEK
MOUNT MONASH
Mt. FIELD EAST 4165 feet
N



(Fig. 1). Lake Fenton (looking East).

(Fig. 2). Lake Fenton (looking N.W.),
National Park, Tasmania.

of long, gently sloping, valleys militated against extensive glaciation on the south and east of Mt. Field East. But in places short glaciers formed and pushed down to about the 3,000 feet level.

One of these glaciers flowed down the valley now filled by Lake Fenton. (See Plate X., Fig. 1.) This was a small flow, arising from the limited snowfield on Kangaroo Moor and the low hills immediately surrounding the lake, and flowing down an old valley, of which the Lady Barron Falls Creek Valley is now the lower portion. The snowfield was too limited to supply a long ice-flow, and the glacier was probably never more than a mile in length, and probably no wider than we now see Lake Fenton. The ice pushed about a quarter of a mile below the present shore of the lake. The bank over which the Lake Fenton pack-track rises just after the sixth mile peg represents the end of the moraine deposited by this glacier.

The valley of the Lady Barron Falls Creek is bounded by the precipitous sides of Seager's Look-Out to the east and Mt. Monash to the west, forming a very sharp V, the sides of which are strewn with a talus of enormous blocks of diabase torn from their seats largely by the action of frost, and tumbled down the slopes in a perfect wilderness of huge rocks. Over the top of this valley the glacier has deposited its moraine until now, looking from Kangaroo Moor through this gap, a distinct U-shaped valley is seen.

The ice appears to have retreated very slowly, but very regularly, covering the bottom of the valley with glacial till extending a quarter of a mile. The surface of this moraine is very level, a noticeable fact on the walk to Lake Fenton, and here and there boulders of all sizes protrude from the reddish soil and gravels. The moraine completely blocks the valley, and dams back Lake Fenton, stretching from a few yards across the overflow from the lake right along the southern shore of the lake, and a little distance on to a spur running down from Mt. Monash.

The outlet from the lake at one time flowed over the eastern end of the moraine, but in the course of time it has washed the earth and lighter materials away from the boulders, and now, except in flood time, runs out of sight below an accumulation of loose rocks of all sizes.

The eastern shore of Lake Fenton is strewn with a mass of huge boulders, which have the appearance of

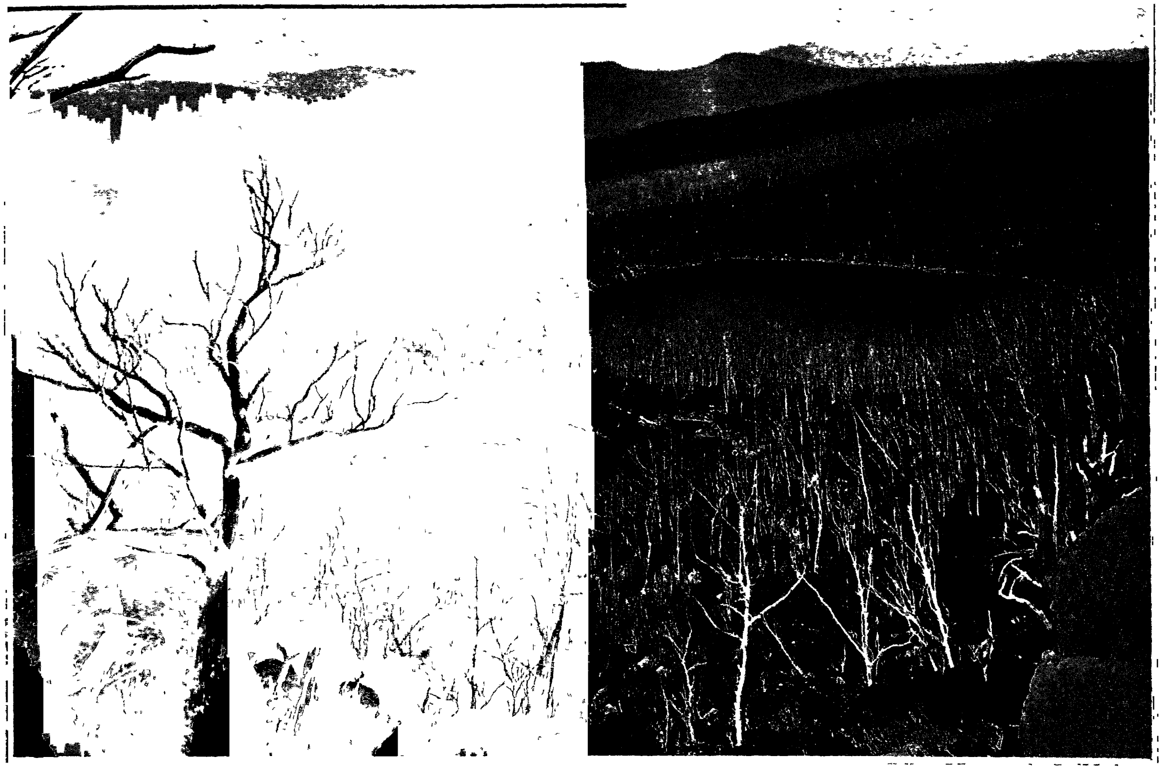
a talus. Perhaps they are the frost-disintegrated remains of a small cliff carved out by the glacier, but more probably are a continuation of the talus slopes on the side of Seager's Look-Out, to be seen below the lake, the bottom portion of which has been covered by glacial and lacustrine deposits, now forming the floor of Lake Fenton. On the western side of the lake there is a narrow shore, which shows slight traces of glaciation, before the ground rises sharply to the hill behind.

Kangaroo Moor, especially along the northern shore of the lake, shows traces of glacial till, and Wombat Moor is covered with erratics, many of tremendous size. Probably a feeder flowed from the snowfields north of Mt. Monash into the Lake Fenton glacier, and about 200 yards from Quiet Corner along the Lake Dobson track there is a ridge of boulders crossing the moor that seems to be a small moraine. Evidently just prior to the vanishing of the glaciers, a small ice flow found its way down from Mt. Monash, scattering debris over Wombat Moor, but melting before it reached Lake Fenton.

(b) The Lake Nicholls Area. (See Plates IX. and XI.)

The southern slope of Mt. Field East drops precipitously some 700 feet from the edge of the plateau. At an altitude of 3,200 feet lies a considerable ledge on the mountain side, on which lie Lake Nicholls and Beattie's Tarn. Circling round the south and south-west of Lake Nicholls, and separating that lake from Beattie's Tarn, is a very considerable ridge of morainal material. This rises sharply from the eastern end of Lake Nicholls to a height of 200 feet above the level of the lake, and forms a round hill between this lake and Beattie's Tarn, from which hill the ridge dips in a wide U northward until it rests on the diabase buttress of Mt. Field East. This U can be distinguished with equal clearness from either Beattie's Tarn or Lake Nicholls. It is extremely steep on both sides, and has the appearance of a pressure ridge, consisting of boulder clay, containing some huge rocks, and probably largely caused by the glacier passing materials up from below and piling them over this bank.

There were probably several small glaciers flowing down the several creases in the otherwise abrupt escarpment of Mt. Field East, the largest of which, flowing down the gully at the head of Lake Nicholls, on reaching the



Lakes Rayner and Nicholls, National Park, Tasmania.

stretch of more level ground, gouged out a considerable portion of the bed of Lake Nicholls, which is of great depth, and shows us a good example of an over-deepened valley. This glacier flowed south-east for a few hundred yards down the branch of the Russell Falls Creek, and deposited a considerable quantity of boulder clay below the outlet from the lake. It is impossible to estimate the depth of this moraine, and difficult to determine how far the glacier descended the valley, but probably it did not flow many hundred yards beyond where we now see the shore of Lake Nicholls.

Another glacier flowing down a gully a little farther to the east was instrumental in forming Lake Rayner. This may have joined the larger Lake Nicholls glacier at a point below both lakes, but this is not certain. It had a smaller snowfield than the other, and probably melted somewhere below the present site of Lake Rayner. The hill below this lake is strewn with glacial debris. During one of its halts during the period of final retreat, it deposited the moraine that now encircles the lower side of Lake Rayner.

(c) Beattie's Tarn Area.

The remaining glacier of this group had its origin immediately west of that of the Lake Nicholls glacier, but flowed west of the intervening ridge down towards the Lady Barron Falls Creek, instead of the Russell Falls Creek. This glacier has left several very prominent, if small, moraines, one of which banks back Beattie's Tarn. On the track to this lakelet one of these moraines is crossed. It stands out ten feet above the surrounding country fifty yards from the shore of the tarn, and consists of small boulders almost free from earth. To the left of the track, as you approach the tarn, another very distinct moraine, similarly constructed, stands out unmistakably. This marks the limit of this glacier, which melted at about the same altitude as the Lake Fenton glacier, a mile farther west.

These traces of past ice action are clearly discernible to even an untrained observer. They lie not six miles from the railway station, on an excellent track, and can be reached on horseback. An energetic person can here study the work of a glacier in the course of a day's trip from Hobart.

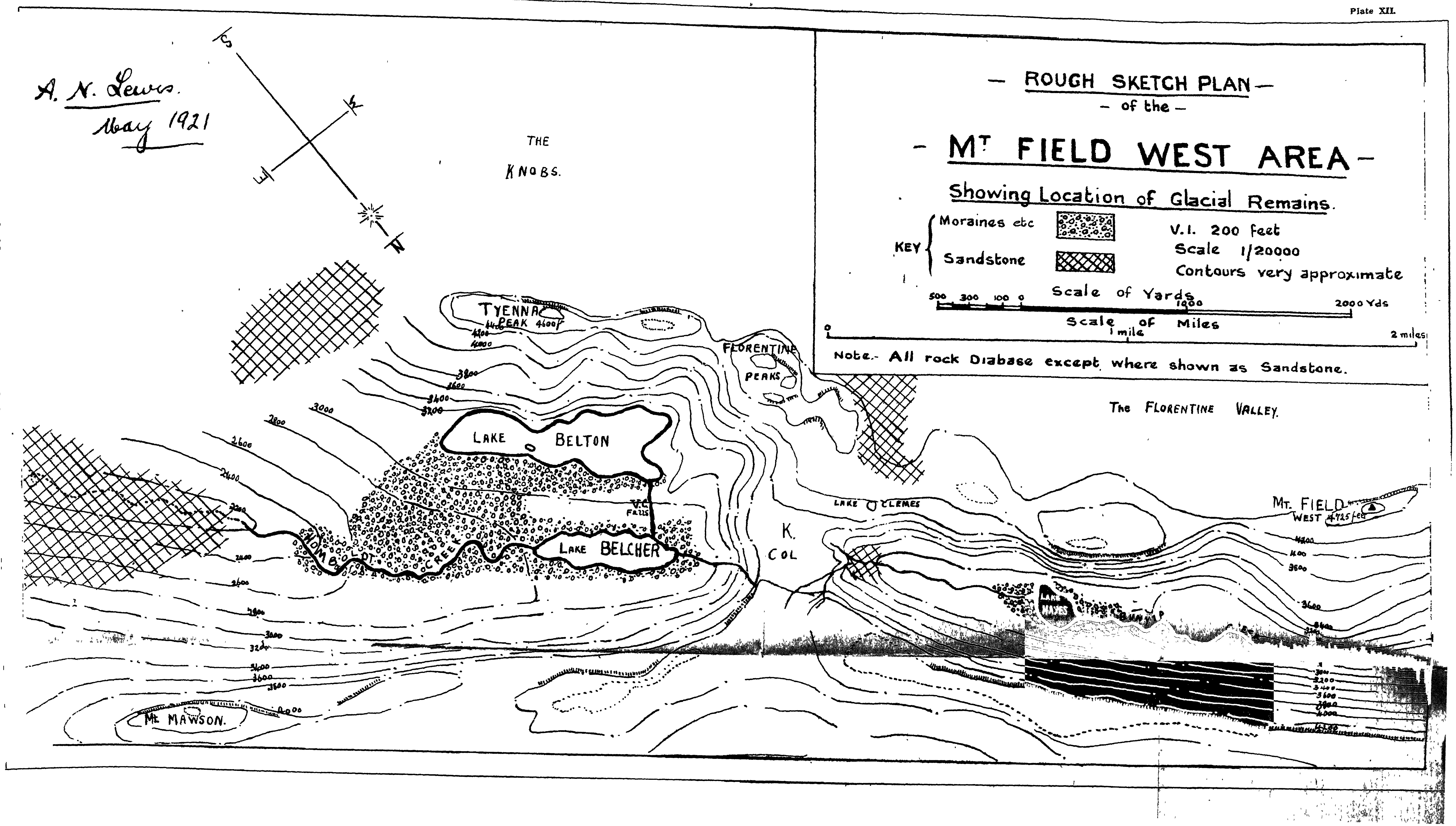
III. THE WESTERN GLACIAL GROUP. (See Plate XII.).

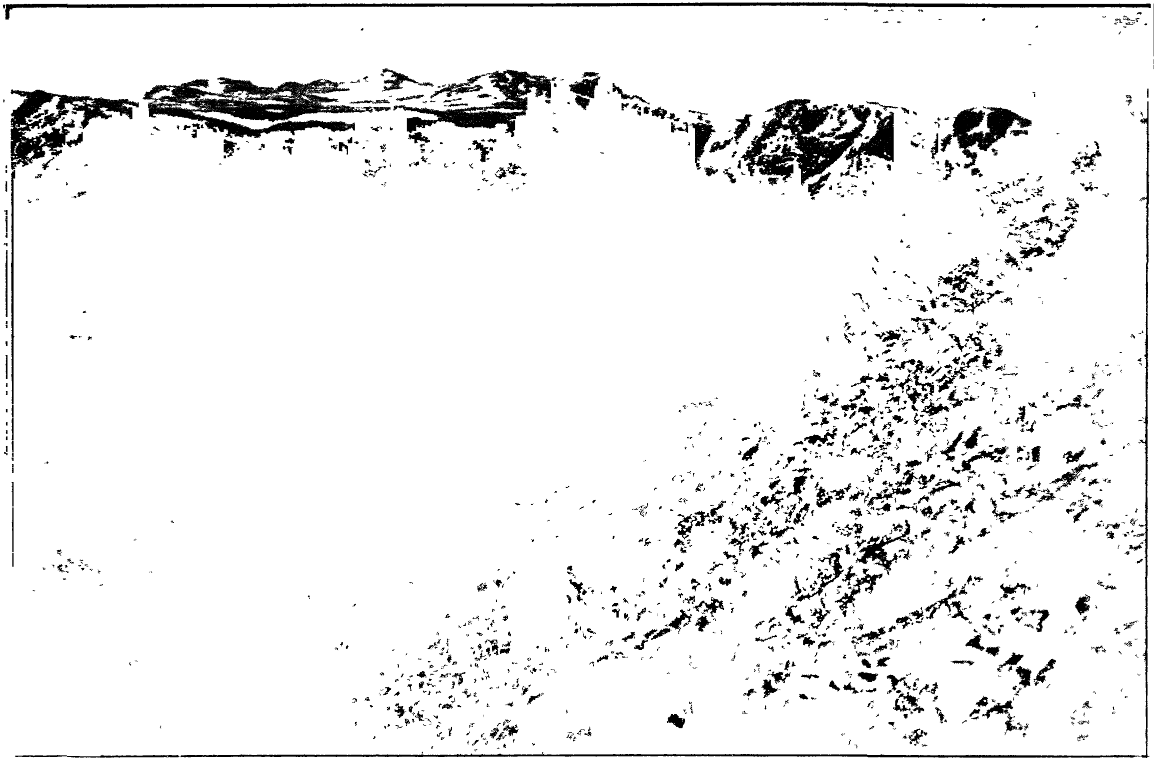
The remaining area of glaciation lies west of the mountain mass running like a wall north from Mt. Mawson to the Derwent, and between that range and the Tyenna Peak-Mt. Field West system. It includes the Belcher-Belton Valley to the south, and the Hayes Valley farther north. Geographically, these lie end to end, separated only by the narrow ridge of K. Col. Before the glacial epoch these two valleys were probably in existence, but sloped in a broad, shallow hollow from K. Col, and the surrounding mountain peaks. Snowfields accumulated around K. Col, and probably precipitation in this part was heavier than farther east. Huge glaciers flowed north and south from K. Col, and their bases cut deep into the foot of that saddle, excavating the pair of enormous cirques we now see, and making K. Col a wonderful example of a Razorback ridge, with sides that stand a thousand feet perpendicularly from the lakes below. Both sides of the ridge are very much alike, and present an excellent example of glacial symmetry, a very uncommon feature.

(a) The Belcher-Belton Valley. (See Plates XIII. and XIV.).

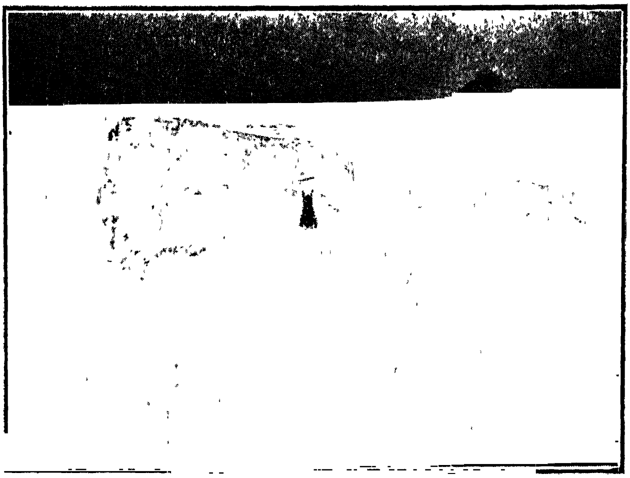
The glacier that filled this valley grew from the enormous snow-covered areas from Mt. Mawson past K. Col, and the Florentine Peaks to Tyenna Peak. It has cut into the mountain, forming an enormous cirque, over two miles long and a mile across, and 1,100 feet deep at the lowest point. It is really a composite cirque, consisting of at least three smaller curves. Down each of these flowed a tributary glacier, one from K. Col (see Plate XIV., Fig 4), a second from the saddle north of the rugged Florentine Peaks, and the third from the plateau between those crags and Tyenna Peak.

This glacier must have pushed over two miles down the valley to an altitude of about 2,700 feet, stopping near the spot where now the button-grass ceases. The floor of the valley is remarkably U-shaped, with a pair of ledges half-way up the sides, on the western of which reposes Lake Belton. The floor of this U is strewn for the whole two miles with a deposit of boulder clay, in which lies Lake Belcher. It is impossible to guess the depth of these deposits, which are remarkably evenly distributed, although piled here and there into the small ridges running at all angles typical of terminal moraine country. In one place,


ROUGH SKETCH PLAN
of the
Mt FIELD WEST AREA
Showing Location of Glacial Remains.
KEY
Moraines etc
Sandstone
V.I. 200 feet
Scale 1/20000
Contours very approximate
Scale of Yards
500 300 100 0 1000 2000 Yds
Scale of Miles
0 1 mile 2 miles
Note.- All rock Diabase except where shown as Sandstone.
A. N. Lewis.
May 1921
S
E
W
N
THE
KNOBS.
TYENNA PEAK 4600f
FLORENTINE PEAKS
LAKE BELTON
LAKE BELCHER
V.C. FALLS
HUMBOLDT CREEK
K. COL
LAKE CLEMES
The FLORENTINE VALLEY.
Mt. FIELD WEST 4725 feet
Mt. MAWSON.
3800
3600
3400
3200
3000
2800
2600
2400
2200



Florentine Peak (also Lakes Belton and Belcher), National Park, Tasmania.



(Fig. 3). Erratics in the Broad River Valley.

(Fig. 4). Lake Belcher and K. Col.

(Fig. 5). Lake Belton and Florentine Peak, National Park, Tasmania.

near the spot where the old Dobson-Belcher track crossed the Humboldt Creek, the water has cut about six feet into the glacial till, and falls in a cascade a few feet high over a layer of this boulder clay that has solidified sufficiently to cause the waterfall, and is almost conglomerate. The matrix is of sand, requiring a hammer to break it, and lying embedded in it are pebbles and cobbles of all sizes. They are absolutely unsorted, and have been worn by the glacier. One was found in the shape of a pyramid, but striæ, if they were ever developed on the diabase, have since rusted away. Perhaps this spot would be a likely place to search for ice-marked pebbles.

Lake Belton presents rather a problem. It appears to have been the work of two glaciers. The inner, or north-west, end is certainly a rock basin, scooped out by the glacier descending the gully that stands at its head, while the lower end is certainly impounded by a moraine that looks to be the work of the southern glacier. This moraine also extends the whole length of the eastern shore, and appears to have been formed either from a line of small glaciers or on the end of an extremely wide ice flow dropping down from Tyenna Peak and the Florentine Peaks. Perhaps this represents the melting point of several glaciers during their later stage, while a main glacier passed down the bottom of the valley, deepening that, and leaving Lake Belton as a hanging valley 300 feet above.

The moraine on the eastern shore of Lake Belton stands 20 or 30 feet above the slope of the hill, and is 100 yards in width, containing many charming pools and tarns. Below Lake Belton the slope of the hill is strewn with morainal material, as if the melting glacier tipped its load down the hillside. The configuration suggests that at a period of maximum glaciation a large glacier filled the valley to a point level with Lake Belton and its corresponding ridge on the eastern slope, scooping out a U-shaped floor in this large valley. Then, as the ice flows shrank, a small glacier cut out a second U within the larger one, at the bottom of the valley, while tributaries melting on the side of the hill were responsible for Lake Belton, making this latter lake an example, if a poor one, of a hanging valley.

(b) The Lake Hayes Valley.

North of K. Col, a shorter glacier, growing from more limited snowfields, was responsible for the tremendous gulch

east of Mt. Field West. It stretched down the valley about a mile to a point just beyond Lake Hayes. It deposited a considerable pile of morainal material that now stretches in a bank a quarter of a mile north of Lake Hayes, and through which the Bunyip Creek has cut to a depth of 50 feet. The glacier must have been melting in this vicinity throughout its existence, withdrawing very slowly and evenly. It deposited this considerable bed of glacial till behind which Lake Hayes now lies, and, gradually shrinking, covered the floor of the valley above the lake with debris.

The moraine is of interest from one point. Unfortunately, throughout the National Park the uniform diabase gives little variety in the textures of these moraines, but here, right in the centre of the cirque at the head of Lake Hayes Valley, is still to be found a tiny pocket of sandstone. This is only about 200 feet in depth, and below it, as above and all round the rock, is diabase. But there are several large blocks of this sandstone visible in the moraine beyond Lake Hayes, over a mile from where its parent bed is now to be seen. Some of these can be seen behind a large clump of King William Pines on the north-west side of the lake. This valley is not as extensive as most of the other areas, but shows the wonderful sculpturing action of an ice-river.

In conclusion, our National Park can afford a student of nature a comprehensive series of examples of the eroding and constructing work of glaciers, enabling him to study at his own back-door these mighty forces, and provides an insight into the geological history of our island, all obtainable with the expenditure of an insignificant expenditure of energy and time. It is doubtful if any other 40,000 acres of the surface of the globe can supply the variety of interests that the public of Tasmania is striving to save from destruction in its National Park.

LIST OF WORKS REFERRED TO IN TEXT.

Reid, A. McIntosh, 1918, "The North Pieman, Huskisson, and Stirling Valley Mining Fields," Geol. Surv. Tas. Bull. No. 28.

Waterhouse, L. L., 1916, "The South Heemskirk Tinfield," Geol. Surv. Tas. Bull., No. 21.

DESCRIPTION OF A NEW SPECIES OF FOSSIL *LORICELLA* (ORDER *POLYPLACOPHORA*). WITH REMARKS ON SOME UNDESCRIBED CHARACTERS PRESENT IN *LORICELLA ANGASI*, AD. AND ANG., AND *L. TORRI*, ASHBY.

By Edwin Ashby, F.L.S., M.B.O.U.

(Communicated by C. E. Lord.)

Plate XV.

(Read 11th July, 1921.)

Mr. E. D. Atkinson, who for many years was resident at Sulphur Creek, North-West Tasmania, early in September last, sent me a very beautiful valve of a Chiton which he had obtained at Table Cape, a locality that has yielded to him and his son many fine forms of fossil mollusca. Three species of *Loricella* from the same locality, and the result of the joint work of the two, were described by Mr. A. F. Basset Hull (in Proc. Lin. Soc. of New South Wales, 1914, Vol. XXXIX., Pt. 4). Since receiving the specimen herein described from Mr. Atkinson, he has passed away. He was an assiduous collector, and many fine forms have been discovered as a result of his earnest labours, and we all owe a debt to his memory.

Mr. Hull, in the paper before mentioned, comments on the large number of species belonging to the genera *Loricella* and *Lorica* represented in the Table Cape deposits, and the apparent dwindling of species in recent times. He states that the genus *Loricella* "is represented by a single living "species," and, speaking of the genus *Lorica*, which also is well represented in the same beds, he says "one only *Lorica* "*volvox*, Reeve, is still extant."

Since Mr. Hull wrote thus, three living forms of this latter genus have been recognised, two of which are Australian, and one from New Zealand, also a second species of *Loricella* has been described by the writer, who, in addition, foreshadows the probability of yet another species being

recognised. While it is evident that these southern seas were exceptionally rich in species belonging to these two genera at the time the Table Cape Beds were laid down, recent research indicates that both genera are better represented by living forms than was thought to be the case when Mr. Hull's paper was written.

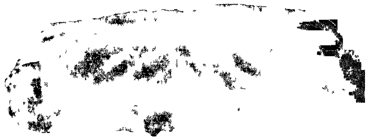
Loricella sculpta, n.sp.

Up to the present one median valve only has been discovered in the Table Cape Beds, but it is in an excellent state of preservation; its beautiful sculpture, which suggests the name I am giving it, is as perfect as it was during life. The shell is remarkably flat, although carinated.

Pleural and Dorsal Areas.—These are evenly decorated with narrow, strongly raised, wavy ribs; these in places are bridged by transverse ribs following the growth lines. These are particularly marked towards the anterior margin, where the transverse ribs resemble a string of small beads. Towards the posterior portion of the valve this feature of the sculpture is somewhat modified, and might be more correctly described as a series of irregularly and widely spaced grooves, following the growth lines and breaking to some extent the longitudinal ribs where they cross. These longitudinal ribs are more or less confluent on the jugum, and to a limited extent in the pleural area.

Lateral Area.—This area is much raised and strongly decorated with coarse, radiating, wavy ribs; these are broken at irregular intervals by deep grooves, which are a continuation of the growth lines which cross the pleural area, and turn abruptly at less than a right-angle across the lateral areas.

Inside.—Eaves well developed, insertion plates 1 slit, evidences of not very pronounced serrations. The sutural laminæ are well developed. and appear to be much less produced forward than is the case with *L. angasi*, Ad. and Ang., the anterior margin throughout being almost straight, but in places it is a little broken; therefore, in a perfect shell, this feature may be less pronounced. The suture is broad, and the slits on either side thereof are absent. The anterior margin of the callus portion is almost straight, and the thickening very pronounced. The tegmentum is folded over the posterior margin in a similar manner to both *L. angasi*, Ad. and Ang., and *L. torri*, Ashby, with this



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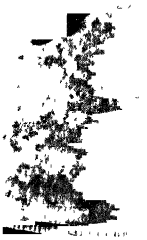

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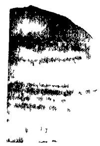

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5

Plate XV.

Fig. 1. *Loricella sculpta*, Ashby. Median valve, upper side.

Fig. 2. *Loricella sculpta*, Ashby. Inside of median valve, showing callus portion and infolded tegmentum.

Fig. 3. *Loricella angasi*, Ad. and Ang. Portion of anterior valve, upper side, showing serrated teeth.

Fig. 4. *Loricella angasi*, Ad. and Ang. Portion of median valve, upper side, showing spade-like process between the sutural laminæ.

Fig. 5. *Loricella torri*, Ashby. Anterior valve, upper side, showing serrated teeth.

difference, that in the fossil the margin is almost straight, whereas in the two species referred to, it curves outwards under the jugum, in a semi-circle.

Note.—The strength and character of the sculpture easily separate this species from any other of the known fossil *Loricella*.

Loricella angasi, Ad. and Ang., and *L. torri*, Ashby.

In my paper on the genus *Loricella* (Trans. Roy. Soc. of S. Austr., Vol. XLIII., p. 61, 1919) reference is made to the lobed suture of the inside of the median valve of *L. angasi*, but only the superficial features distinguishing *L. torri*, Ashby, from that species were dealt with, as the valves were not disarticulated. It has now been possible to examine disarticulated specimens of both species. The sinus or space separating the sutural laminæ in the median valves is very broad, with a deep slit at each side, this slit penetrating to the tegmentum, having a spade-like process, with a denticulate margin, between the two slits. This feature is present in both the two living species, but in the fossil one under review these slits are either entirely absent or rudimentary. It suggests that this feature may have been developed in recent times, in which case the fossil *Loricella* might very properly receive sub-generic distinction.

The examination of separated valves for the purposes of this paper has revealed a further difference between *L. angasi* and *L. torri*.

While the latter has, especially in the anterior valve, sharply serrated and deeply propped and cut teeth, the teeth in the former *L. angasi*, as compared with it, are comparatively blunt, and the propping much less finely cut. The fossil species under review seems more closely to approach *L. angasi* in this respect.

Note.—Carpenter MS. is quoted by Pilsbry (Man. Con. Vol. XIV., 239) as follows, referring to *L. angasi*, Ad. and Ang.:—"The sutural plates separated, but having a lamina "between them, which is sometimes bilobate or denticulate," and again, "the sinus having a separate lamina, somewhat "lobed." The figure 11, pl. 51, in same volume, does not at all represent this character as it really is, I have therefore photographed a median valve of that species showing this spade-like process, which separates the sutural laminæ, and I also figure a photograph of the anterior valve of both species showing the serrated teeth, which are in both strongly

propped outside, but only showing propping in the inside in the case of *L. torri*, Ashby. This is the first time that a dissected valve of this latter has been figured. The type of *Loricella sculpta*, Ashby, has been presented to the Tasmanian Museum, Hobart. (Tas. Museum No. C. 1672.)

EXPLANATION OF PLATE XV.

Fig. 1. *Loricella sculpta*, Ashby. Median valve, upper side.

Fig. 2. *Loricella sculpta*, Ashby. Inside of median valve, showing callus portion and infolded tegmentum.

Fig. 3. *Loricella angasi*, Ad. and Ang. Portion of anterior valve, upper side, showing serrated teeth.

Fig. 4. *Loricella angasi*, Ad. and Ang. Portion of median valve, upper side, showing spade-like process between the sutural laminæ.

Fig. 5. *Loricella torri*, Ashby. Anterior valve, upper side, showing serrated teeth.

AUSTRALIAN BOMBYLIIDÆ AND CYRTIDÆ (DIPTERA).

By G. H. Hardy.

Plates XVI. and XVII.

(Read 11th July, 1921.)

This catalogue of the *Bombyliidæ* and *Cyrtidæ* of Australia contains a key to the genera, and the description of two new species belonging to genera in which no previous species have been described from Australia. Also, there are numerous synonyms suggested, and a number of species have been placed in the genera they more readily conform to than those in which they were originally placed.

BOMBYLIIDÆ.

This study of the *Bombyliidæ* is based upon several important collections. One of these, the Macleay Museum collection, contains a large number of species, many of which appear to be new, and it forms the basis for the study of the species described from Australia. The writer's own collection contains species conforming to most of those described from Tasmania by White, and also contains specimens from Western Australia and New South Wales. A small, but very valuable, collection formed by Dr. E. W. Ferguson, contains some specimens identified by White by comparison with Walker's types in the British Museum, and has been valuable in establishing the identity of some of the species. Other specimens, including those in the Australian Museum, the Queensland Museum, and the Agricultural Department of Queensland, have also been examined.

Much of the material in the above collections is inferior in condition, and as many of the species are closely related, making the differences between them difficult to determine from old specimens, it is advisable to wait till sufficient new material has accumulated before revising the species within the various genera.

The Australian species have been described under nearly one hundred and fifty names, of which less than one hundred are distinct, and of these fifty-two are recognised in the collections under revision.

A study of the Australian species shows conclusively that the generic characters utilised by various authors are often of less than specific value, and this is especially the case in the *Anthracinæ* and *Lomatiinæ*, and the taxonomy of the *Bombyliinæ* is complicated by the existence of species that contain graduating characters between some of the genera.

For all practical purposes the key given below will serve to separate the described species into groups of more or less generic value.

Key to the Genera of the Australian Bombyliidæ.

1. The bifurcation of the radial and cubital veins takes place at right angles and near the median cross vein. *ANTHRACINÆ*. 4.
   The bifurcation of the radial and cubital veins takes place at an acute angle at a considerable distance from the median cross vein. 2.
2. The radial vein, curving upwards at its apex, often forms an open loop, and always runs into the costa at an obtuse or right angle. The antennæ short, with the basal joint very thick. The abdomen generally more or less long, parallel sided, and depressed. *LOMATIINÆ*. 8.
   The radial vein normal, and running into the costa at an acute angle. 3.
3. The abdomen elongate, more or less compressed and cylindrical. *SYSTROPINÆ*. 11.
   The abdomen short, conical or oval. *BOMBYLIINÆ*. 14.

ANTHRACINÆ.

4. The proboscis projecting beyond the epistoma. *Cytheræ*.
   The proboscis not, or scarcely, projecting beyond the epistoma. 5.
5. The apex of the antennæ bearing a tuft of hairs. *Argyramœba*.
   The apex of the antennæ at most with a style, never with a tuft of hairs. 6.
6. The third joint of the antennæ prolonged to a style-like process, at most with a minute differentiated style. *Anthrax*.
   The antennal style long and distinct, separated from the prolonged third antennal joint by a distinct suture. 7.

7. Three submarginal cells present. *Exoprosopa.*
Four submarginal cells present. *Hyperalonia.*

LOMATIINÆ.

8. The abdomen cylindrical or slightly compressed. *Docidomyia.*
The abdomen depressed. 9.
9. The radial vein curved upwards, and forming at most a very small loop. The abdomen narrow, parallel-sided. *Lomatia.*
The radial vein forming a loop at least as long as wide before running into the costa. 10.
10. The radial veing forming a loop about as long as wide. The abdomen always broad. *Oncodocera.*
The radial vein forming a loop at least twice as long as wide; if, however, the loop is small the abdomen is invariably long and narrow. *Comptosia.*

SYSTROPINÆ.

11. The wings with only two veins issuing from the discal cell. *Systropus.*
The wings with three veins issuing from the discal cell. 12.
12. The abdomen with only six segments. *Antoniaustralia.*
The abdomen with more than six segments. 13.
13. The palpi short, scarcely one-third the length of the proboscis; the thorax considerably arched; the thorax and head with bristles; the legs with long spines. *Marmasoma.*
The palpi long, three-quarters the length of the proboscis; the thorax not conspicuously arched; the head and thorax without bristles; the legs with small inconspicuous spines. *Eclimus.*

BOMBYLIINÆ.

14. The discal cell wanting. *Cyrtomorpha.*
The discal cell present. 15.
15. The wings with two veins issuing from the discal cell. *Geron.*
The wings with three veins issuing from the discal cell. 16.
16. The anal cell closed. 17.
The anal cell open. 18.

17. The third joint of the antennæ and the face with long hairs in both sexes. The cubital fork with an appendix. *Acreotrichus.*
    The third joint of the antennæ and the face bare in the female. The cubital fork without an appendix. *Phthiria.*
18. The first posterior cell open, at most closed at the wing border. 19.
    The first posterior cell closed considerably before the wing border. 20.
19. The first basal cell much longer than the second; *i.e.*, the intermediate cross vein is situated towards or beyond the middle of the discal cell. *Dischistus.*
    The two basal cells of about equal length; *i.e.*, the intermediate cross vein is situated near the base of the discal cell. *Sisyromyia.*
20. The two basal cells of about equal length. *Systœchus.*
    The first basal cell much longer than the second. *Bombylius.*

ANTHRACINÆ.

Genus *Hyperalonia*, Rondani. (Pl. XVI., fig. 1.)

Hyperalonia, Rondani, Archiv. per la Zool. iii., 1863, p. 58.

Hyperalonia satyrus, Fabricius.

Bibio satyrus, Fabricius, Syst. Ent., 1775, p. 758; and Sp. Ins. ii., 1781, p. 415; and Mant. Ins., ii., 1787, p. 329.

Musca satyrus, Gmel. Syst. Nat. v., 1792, p. 2,831.

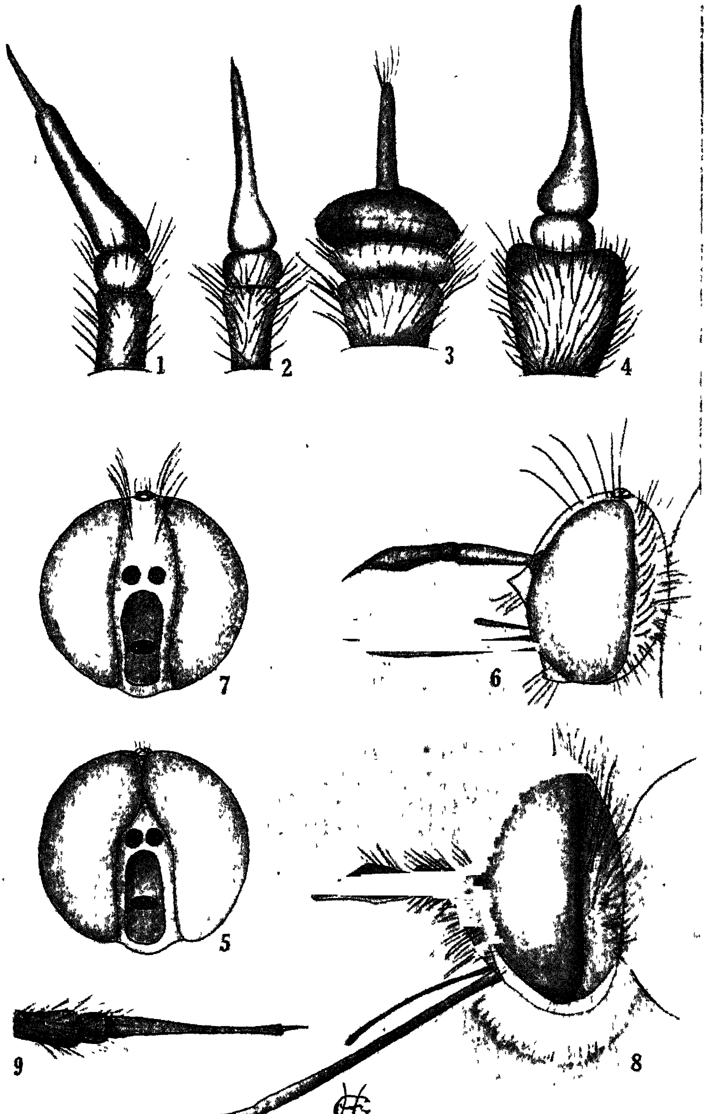
Anthrax satyrus, Fabricius, Ent. Syst. iv., 1794, p. 259; and Syst. Ant., 1805, p. 123. *Id.*, Wiedemann, Dipt. Exot., 1821, p. 151; and Auss. zweifl. Ins., i., 1828, p. 322. *Id.*, Walker, List Dipt. B.M., ii., 1849, p. 243; and Ins. Saund. Dipt., 1852, p. 166.

Exoprosopa satyrus, v. d. Wulp, Tijd. v. Ent. (2), iii. (xi.), 1868, p. 106, Pl. iii., fig. 10. *Id.*, Osten-Sacken, Cat. Dipt. N. Amer., ed. 2, 1878, p. 87, note. *Id.*, v. d. Wulp, Cat. Dipt. S. Asia, 1896, p. 69.

Anthrax funestra, Walker, List Dipt., B.M., ii., 1849, p. 242.

Exoprosopa funestra, Walker, Ins. Saund., Dipt. i., 1852, p. 165.

Exoprosopa insignis, Macquart, Dipt. Exot., suppl. 5, 1855, p. 73, Pl. iii., fig. 7. *Id.*, Bergroth, Stett. Ent. Zeit., lv., 1894, p. 72.



Australian Bombyliidæ.

Synonymy.—This species was described from Novæ Hollandiæ in 1775 from a specimen collected by Banks, and in 1778 Fabricius gives China as a locality; both these localities were repeated in 1794. Walker, in 1849, gives Georgia as the locality (perhaps King George's Sound was originally intended), and Osten Sacken in 1878 states that the species is not American.

In 1868 van der Wulp described and figured a specimen from Aru Island under the name, and this determination is accepted here as correct.

The identity of Fabricius' species has been fixed by description and figure on the authority of van der Wulp. Species in various collections conforming to van der Wulp's description are named by myself *Hyperalonia satyrus*, Fabricius. The same species has been named by Major E. E. Austen as *Hyperalonia funesta*, Walker, and is represented by a specimen so determined in the Queensland Museum; on this account Walker's name is placed here as a synonym. The description of *Exoprosopa insignis*, Macquart, also conforms to this species.

Hab.—There are twenty-four specimens in the Macleay Museum with labels bearing the following localities:—Northern Territory: Port Darwin. Queensland: Cape York, Rockhampton, Port Denison, Port Curtis, Endeavour River, and Lizard Island. New South Wales: Piper's Flats and Newcastle. South Australia. There are further specimens in other collections.

In the Agricultural Department of Queensland there is a specimen, bearing a label by Mr. Edmund Jarvis, and it conveys the information that the species is a hyperparasite on the scolid wasp *Dielis sp.* (now known as *Campsomerus radula*), which is a parasite on sugar-cane grubs.

Under the name *Hyperalonia funesta*, Walker, Mr. Jarvis also informs me that this species is a parasite of an Asilid, which is predaceous in the larval form upon the banana root weevil, *Calandra sordida*.

Hyperalonia sinuatifascia, Macquart.

Exoprosopa sinuatifascia, Macquart, Dipt. Exot., suppl. 5, 1855, p. 72, Pl. iii., fig. 6.

Exoprosopa macraspis, Thomson, Eugenies Resa, Dipt., 1868, p. 479.

Hyperalonia argenticincta, Bigot, Ann. Soc. Ent. France (7), xli., 1892, p. 343.

Synonymy.—Specimens identified as belonging to Macquart's species were compared with the descriptions of Thomson and Bigot and found to agree.

Hab.—The three descriptions record the species from New South Wales, and two specimens, undoubtedly belonging here, were collected at Sydney during January, 1919, and at Blackheath, Blue Mountains, during November, 1919, respectively. In the Macleay Museum one specimen is labelled "South Australia."

Hyperalonia bombyliformis, Macleay.

Anthrax bombyliformis, Macleay, in King's narrative Surv. S. Austr., ii., 1830, p. 468. *Id.*, Wiedemann, Auss. zweifl. Ins. ii., 1830, p. 648. *Id.*, Walker, List Dipt., B.M., ii., 1849, p. 241. *Id.*, Kirby, Ann. Mag. Nat. Hist. (5), xiii., 1884, p. 458.

Ligyra bombyliformis, Newman, Entom. i., 1841, p. 220. *Id.*, Walker, Ins. Saund. Dipt., 1852, p. 166.

Exoprosopa punctipennis, Macquart, Dipt. Exot., suppl. 4, 1849, p. 106, Pl. x., fig. 4.

Exoprosopa albiventris, Thomson, Eugenies Resa, Dipt., 1869, p. 480.

Synonymy.—The type of *Anthrax bombyliformis*, Macleay, is probably not traceable, and the description is confined to about four lines. It is described as having several discoidal spots on the wing, and from this character the known species to which it could be referred are limited to two species of *Lomatiinæ*, neither of which can in any way be associated with other described characters, and to a few species of *Anthracinæ*.

A comparison of the description with some specimens independently identified as *Exoprosopa punctipennis*, Macquart, shows that Macleay's description conforms satisfactorily to that species.

Hab.—This species, apparently, has a wide range. Twenty-one specimens in the Macleay Museum are labelled as follows:—One from King's Sound, North-West Australia; from Queensland there are six labelled Port Denison, five Cape York, and one Percy Island; eight are from New South Wales, two of which are labelled Piper's Flats. There are also specimens in the Australian Museum and in other collections.

Hyperalonia cingulata, v. d. Wulp.

Exoprosopa cingulata, v. d. Wulp, Notes Leyden Mus., vii., 1885, p. 62.

Hab.—The species was described from Adelaide. In the Macleay Museum there is one specimen from South Australia, one from Port Denison, and one from Darling River.

Genus *Exoprosopa*, Macquart.

Exoprosopa, Macquart, Dipt. Exot., ii. (1), 1840, p. 35. *Id.*, White, Proc. Roy. Soc. Tasm., 1916, p. 205.

Note.—Four names are placed under this genus, and two of these belong to recognised species. The other two names apparently belong to distinct species which are not represented in the collections examined.

Exoprosopa laterimbata, Bigot.

Exoprosopa laterimbata, Bigot, Ann. Ent. Soc. France (7), lxi., 1892, p. 346.

Note.—The third segment of the abdomen has a white lateral fascia, which reaches almost to the median line. The species was described from a specimen with incomplete antennæ and denuded abdomen.

Hab.—Five specimens in the Macleay Museum are identified as belonging to Bigot's species, and are labelled from:—Western Australia; Queensland, including Port Denison and Rockhampton; and New South Wales.

Exoprosopa stellifer, Walker.

Anthrax stellifer, Walker, List Dipt. B.M., ii., 1849, p. 244.

Litorhynchus stellifer, Walker, Ins. Saund. Dipt., 1852, p. 166.

Variations.—Two specimens of a series agree with Walker's description too well to be mistaken, but the remainder have the hyaline area of the wings varying from a narrow strip to a triangular area which reaches from the hind border to a point slightly beyond half the length and nearly across the discal cell. The basal half of the abdomen is sometimes brown with a black median stripe, and the white abdominal fascia may form a band almost reaching across the abdomen or may be obsolete.

Hab.—Western Australia. In the Queensland Museum there is a specimen labelled "Cunderdin." South Australia: there are eight specimens in the Macleay Museum from this State.

Exoprosopa adelaidica, Macquart.

Exoprosopa adelaidica, Macquart, Dipt. Exot., suppl. 5, 1855, p. 70, Pl. iii., fig. 4.

Note.—Several specimens are attributed to this species in various collections, but they do not come from the type locality, nor do they agree sufficiently closely with the description.

Hab.—Adelaide.

Exoprosopa obliquifasciata, Macquart.

Exoprosopa obliquifasciata, Macquart, Dipt. Exot., suppl. 4, 1850, p. 107, Pl. x., fig. 5. *Id.*, White, Proc. Roy. Soc. Tasm., 1916, p. 205.

Hab.—This species was described from Tasmania, but no recent specimen of the genus is known from the locality. Many of the species of Diptera recorded from Tasmania by Macquart are now found to be from the Northern portions of Australia, and perhaps this is another instance of incorrect locality.

Genus *Anthrax*, Scopoli. (Pl. XVI., fig. 2.)

Anthrax, Scopoli, Ent. Carl., 1763, p. 358. *Id.*, White, Proc. Roy. Soc. Tasm., 1916, p. 206.

Note.—Nine species described under the generic name *Anthrax* appear to belong to that genus in its restricted sense. The majority of these forms have been identified from their descriptions in the various collections examined.

Anthrax alterna, Walker.

Anthrax alterna, Walker, List Dipt. B.M., ii., 1849, p. 261.

Anthrax alternans, Macquart, Dipt. Exot., suppl. 4, 1850, p. 110. *Id.*, White, Proc. Roy. Soc. Tasm., 1916, p. 208.

Synonymy.—It appears that Walker's species from Australia is the same as White's identification of *A. alternans*, Macquart, from Tasmania.

Anthrax argentipennis, White.

Anthrax argentipennis, White, Proc. Roy. Soc. Tasm., 1916, p. 212.

Anthrax commista, Macquart.

Anthrax commista, Macquart, Dipt. Exot., suppl. 4, 1850, p. 109, Pl. x., fig. 10.

Anthrax consimilis, Thomson, Eugenies Resa, Dipt., 1868, p. 481.

Synonymy.—The above synonymy appears to be correct according to the descriptions, which agree with some specimens in the Macleay Museum.

Anthrax fuscicostata, Macquart.

Anthrax fuscicostata, Macquart, Dipt. Exot., suppl. 1, 1846, p. 111. *Id.*, Schiner, Novara Reisa, 1868, p. 126.

Anthrax marginata, Walker, Ins. Saund. Dipt., 1850, p. 178. *Id.*, White, Proc. Roy. Soc. Tasm., 1916, p. 210.

Anthrax albirufa, Walker, Trans. Ent. Soc. Lond., iv., 1857, p. 143.

Synonymy.—White gives Macquart's name as a synonym of *A. marginata*, Walker, although Macquart described the species four years earlier than Walker. *A. albirufa*, Walker, appears from the description to be the same species.

Anthrax minor, Macquart.

Anthrax minor, Macquart, Dipt. Exot., suppl. 4, 1850, p. 111. *Id.*, White, Proc. Roy. Soc. Tasm., 1916, p. 208.

Anthrax vitrea, Walker, Ins. Saund. Dipt., 1850, p. 181.

Synonymy.—The above synonymy is given on the authority of White, who makes no remarks concerning it. Macquart's species is from Tasmania, and Walker's from Western Australia.

Anthrax nigricosta, Macquart.

Anthrax nigricosta, Macquart, Dipt. Exot., suppl. 4, 1850, p. 111. *Id.*, Froggatt, Austr. Ins., 1907, p. 296. *Id.*, White, Proc. Roy. Soc. Tasm., 1916, p. 209.

Anthrax pellucida, Walker, Ins. Saund. Dipt., 1854, p. 182.

Synonymy.—White overlooked Walker's description, which conforms to *A. nigricosta*, Macquart, and also was described from Tasmania.

Hab.—White records the species from New South Wales, South Australia, Victoria, and Tasmania. On Cradle Mountain, Tasmania, this species occurred in vast quantities, and was the only species of the genus taken there during January, 1917.

Anthrax resurgens, Walker.

Anthrax resurgens, Walker, List Dipt. B.M., ii., 1849, p. 259.

Anthrax simplex, Macquart.

Anthrax simplex, Macquart, Dipt. Exot., suppl. 2, 1847, p. 52, Pl. ii., fig. 4. *Id.*, White, Proc. Roy. Soc. Tasm., 1916, p. 212.

Note.—Two specimens in Dr. Ferguson's collection were identified by White as this species. They are numbered 233 and 234, and were collected in Sydney by Gibbons.

Anthrax velox, White.

Anthrax velox, White, Proc. Roy. Soc. Tasm., 1916, p. 211.

Note.—White compares this species with *A. albirufa*, Walker, which is here placed under *A. fuscicostata*, Macquart. He also compares it with *A. marginata*, Walker, also placed here under the same.

The species is not recognised in the collections under revision.

Genus *Argyramœba*, Schiner.

Argyramœba, Schiner, Wien. Entom. Monatschr., iv., 1860, p. 51. *Id.*, White, Proc. Roy. Soc. Tasm., 1916, p. 213.

Note.—Four described species are placed here, and three of them have been recognised and labelled in the various collections.

Argyramœba concisa, Macquart.

Anthrax concisa, Macquart, Dipt. Exot., suppl. 4, 1850, p. 111, Pl. x., fig. 11. *Id.*, Schiner, Reise Novara, Dipt., 1868, p. 125.

Hab.—New South Wales. One specimen in the Macleay Museum.

Argyramœba incompta, Walker.

Anthrax incompta, Walker, List. Dipt. B.M., 1849, ii., p. 253.

Hab.—The species was originally described from Western Australia. In the Macleay Museum there are twenty-five specimens from South Australia, two from New South Wales, and four from Cape York, Queensland, all of which are referable to this species.

Argyramœba maculata, Macquart. (Pl. XVI., fig. 3.)

Anthrax maculata, Macquart, Dipt. Exot., suppl. 1, 1846, p. 112, Pl. ix., fig. 12.

Argyramœba maculata, White, Proc. Roy. Soc. Tasm., 1916, p. 213.

Anthrax australis, Walker, Ins. Saund. Dipt., 1850, p. 193.
Anthrax diana, Walker, List Dipt. B.M., 1849, p. 252.

Synonymy.—*Anthrax diana*, Walker, was described from a specimen without a locality and without a head. A series of specimens in the Queensland Museum, from which one was sent to and identified by Major E. E. Austen as *A. diana*, Walker, is identical with *Argyramœba maculata*, Macquart. Walker's description agrees with this species, and therefore the above information is accepted.

Hab.—Australia and Tasmania.

Argyramœba semimacula, Walker.

Anthrax semimacula, Walker, List Dipt. B.M., ii., 1849, p. 254.

Note.—This species is undoubtedly placed here in its right genus, but it has not been recognised in the collections under revision.

Genus *Cytherea*, Fabricius.

Cytherea, Fabricius, Ent. Syst., iv., 1794, p. 413.

Note.—There is one species belonging to this genus described from Australia. There are also three undescribed species, one in the Australian Museum, one in the Macleay Museum, and the third in Dr. Ferguson's collection.

Cytherea lipposa, Bigot.

Glossista lipposa, Bigot, Ann. Ent. Soc. France (7), lxi., 1892, p. 353.

Note.—This species, described from a mutilated specimen from Sydney, has not been recognised in the collections under revision.

Species of uncertain generic position.

Four of Macquart's species have not been recognised and their generic positions are uncertain.

Exoprosopa bicellata, Macquart, Dipt. Exot., suppl. 2, 1847, p. 51, Pl. ii., fig. 2. *Id.*, White, Proc. Roy. Soc. Tasm., 1916, p. 206. (Tasmania.)

Anthrax flaveola, Macquart, Dipt. Exot., suppl. 4, 1850, p. 109. (Eastern Australia.)

Anthrax incisa, Macquart, Dipt. Exot., suppl. 2, 1847, p. 52, Pl. ii., fig. 3. *Id.*, White, Proc. Roy. Soc. Tasm., 1916, p. 207. (Tasmania.) This species is said to

have the abdomen with the apex silvery, and on this account the probable position would be under the genus *Argyramœba,* many species of which have this character.

Anthrax obscura, Macquart, Dipt. Exot., suppl. 1, 1846, p. 112. (Australia.)

Anthrax angularis, Thomson, Eugenies Resa, Dipt., 1868, p. 482. (New South Wales.)

LOMATIINÆ.

Genus *Lomatia*, Meigen. (Pl. XVII., fig. 10.)

Lomatia, Meigen, System. Beschreib., iii., 1822.

Lomatia sobicula, Walker.

Anthrax sobicula, Walker, Trans. Ent. Soc. Lond., iv., 1857, p. 144.

Lomatia australis, Schiner, Novara Reise, Dipt., 1868, p. 129.

Synonymy.—Two specimens in Dr. Ferguson's collection, numbered 119 and 241, were identified by White as *Anthrax sobicula*, Walker, and were evidently compared with the type. Schiner's description appears to conform to the same species, which is represented by specimens from Sydney in most collections.

Lomatia (?) *subsenex*, Walker.

Anthrax subsenex, Walker, Trans. Ent. Soc. Lond., iv., 1857, p. 144.

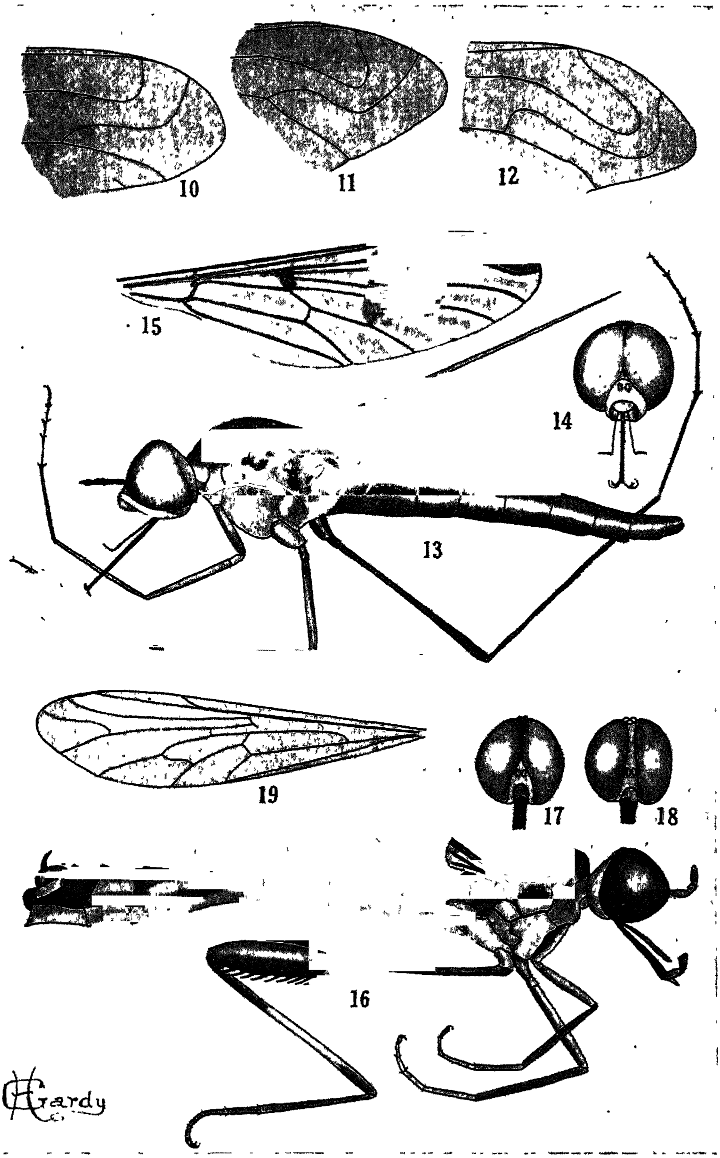
Status.—Judging from the comparison of descriptions between Walker's two species, it appears certain that they refer to the same genus, and, therefore, if *Anthrax sobicula* is referred to the genus *Lomatia,* it is probable that *Anthrax subsenex* belongs to the same group.

Genus *Oncodocera*, Osten-Sacken. (Pl. XVII., fig. 11.)

Ogcodocera, Macquart, Dipt. Exot., ii. (1), 1840, p. 83.

Oncodocera, Osten-Sacken, Bull. U.S. Stat. Geol. Surv. of Territories (Heyden), iii., 1877, p. 247.

Description.—Six species of *Lomatiinæ* do not seem to conform to the characters of any genus better than those of *Oncodocera*, as illustrated by Williston in *North American Diptera*, 3rd edition, 1908, fig. 82. The following characters, taken from specimens of the group so far known, will help to isolate them from their nearest allies:—



Australian Bombyliidæ.

Eyes contiguous in the male, separate in the female. Thorax a little broader than the head, broader posteriorly than anteriorly. Abdomen broader than the thorax. The abdomen of *Lomatia* is slender, rather elongate and parallel sided; that of *Oncodocera* is broad and not much longer than wide; the species of *Comptosia* have their abdomen generally like that of *Lomatia,* but vary to something approaching but not quite like that of *Oncodocera.* The latter case only occurs in a few large species, which can be readily separated by the difference in the loop of the radial vein.

Oncodocera ampla, Walker. (Pl. XVII., fig. 11.)

Anthrax ampla, Walker, Ins. Saund. Dipt., 1850, pp. 167 and 185.

Description.—In the male the wing contains two recurrent veinlets situated on the vein between the discal and third posterior cells, one running into each of these cells; this character is not represented in the female nor in the other species placed under this genus.

Hab.—Described from Western Australia; there are two males and two females from this State in the Australian Museum. In the Macleay Museum there are two males and two females from South Australia.

Oncodocera anthracina, Thomson.

Comptosia anthracina, Thomson, Eugenies Resa, 1868, p. 485.

Lygira rubrifera, Bigot, Ann. Soc. Ent. France (6), i., 1881, p. 23.

Synonymy.—The above synonymy appears to be correct. The species must not be confused with various species of the genus *Comptosia,* which have a general similar appearance; the curvature of the radial vein will readily distinguish them.

Hab.—In the Macleay Museum there are seven specimens from South Australia and one from Piper's Flats, New South Wales. In Dr. Ferguson's collection there is one specimen from Victoria labelled "Mallee."

Oncodocera murina, Newman.

Neuria murina, Newman, Entom., i., 1841, p. 221.

Oncodocera patula, Walker.

Anthrax patula, Walker, List Dipt. B.M., ii., 1849, p. 273.
Id., Walker, Ins. Saund. Dipt., 1852, p. 168.

Oncodocera plana, Walker.

Anthrax plana, Walker, List Dipt. B.M., ii., 1849, p. 272. *Id.*, Walker, Ins. Saund. Dipt., 1852, p. 168.

Oncodocera tendens, Walker.

Anthrax tendens, Walker, List Dipt. B.M., ii., 1849, p. 271. *Id.*, Walker, Ins. Saund. Dipt., 1852, p. 168.

Hab.—Six specimens from Perth, Western Australia, were collected during or about December, 1911.

Genus *Comptosia*, Macquart. (Pl. XVI., fig. 4; Pl. XVII., fig. 12.)

Comptosia, Macquart, Dipt. Exot., ii. (1), 1840, p. 80. *Id.*, White, Proc. Roy. Soc. Tasm., 1916, p. 201.

Neuria, Newman, Entom., i., 1840, p. 220.

Ligyra, Newman, Entom.. i., 1840, p. 220. *Id.*, Becker, Ann. Mus. Zool. St. Petersb., xvii., 1912, p. 466, fig.

Alyosia, Rondani, Arch. per la Zool., iii., 1863, p. 54. *Id.*, Becker, Ann. Mus. Zool. St. Petersb., xvii., 1912, p. 465.

Synonymy.—The type of genus *Comptosia* is *C. fascipennis*, Macquart, which is queried from Monte Video; and is supposed to have a white uniformly wide subapical band, three posterior cells, and an appendix. In Dr. Ferguson's collection, a specimen of *C. lateralis*, Newman, was identified by White as *C. fascipennis*, Macquart, and in accordance with the somewhat doubtful type locality this specimen must remain on record under the type specific name until the point of doubt concerning the locality can be settled.

The type of the genus *Neuria* is *N. lateralis*, Newman, from Sydney.

Newman placed *Anthrax bombyliformis*, Macleay, and *Anthrax silvanus*, Fabricius, under the genus *Ligyra*, and the former he gives as the representative. Macleay's species is placed here under the genus *Hyperalonia*, and Fabricius's species is apparently a large form of the species well known under the name *C. corculum;* Rondani gives the Chilian species, *L. lugubris*, Rondani, as the type species of *Ligyra*, and in this is followed by Becker.

The genus *Alyosia*, Rondani, is represented by the Tasmanian species *C. maculipennis*, Macquart, for the type.

For the purpose of this paper these genera cannot be accepted, and, indeed, considerable further study will be

necessary before an adequate conclusion can be reached concerning the value of characters usually adopted for generic division in the subfamily.

Comptosia ocellata, Newman.

Neuria ocellata, Newman, Entom., i., 1841, p. 221. *Id.*, Walker, Ins. Saund. Dipt., 1852, p. 167.

Anthrax ocellata, Walker, List Dipt. B.M., ii., 1849, p. 268.

Comptosia maculipennis, Macquart, Dipt. Exot., suppl. 1, 1846, p. 116. *Id.*, White, Proc. Roy. Soc. Tasm., 1916, p. 201.

Anthrax inclusa, Walker, List Dipt. B.M., ii., 1849, p. 268.

Anthrax cognata, Walker, Ins. Saund. Dipt., 1852, p. 177.

Synonymy.—The above synonymy is given on the authority of White.

Hab.—*Anthrax cognata* was described from Western Australia, the others from Tasmania. One specimen from Piper's Flats, New South Wales, and two from Cape York, Queensland, are in the Macleay Museum. Other specimens represented in various collections are from Tasmania.

Comptosia sylvana, Fabricius.

Bibio sylvanus, Fabricius, Syst. Ent., 1775, p. 758; and Sp. Ins., ii., 1781, p. 415; and Mant. Ins., ii., 1781, p. 329.

Musca sylvanus, Gmelin, Syst. Nat., v., 1792, p. 2,832.

Anthrax sylvanus, Fabricius, Ent. Syst. iv., 1794, p. 261; and Syst. Antl., 1805, p. 125. *Id.*, Wiedemann, Dipt. Exot., 1821, p. 151; and Auss. zweifl. Ins., i., 1838, p. 321. ?*Id.*, Walker, List Dipt. B.M., ii., 1849, p. 241; and Ins. Saund. Dipt., i., 1852, p. 166.

Neuria atherix, Newman, Entom., i., 1841, p. 222. *Id.*, Walker, Ins. Saund. Dipt., 1852, p. 167.

Neuria corculum, Newman, Entom., i., 1841, p. 221. *Id.*, Walker, Ins. Saund. Dipt., 1852, p. 167.

Atherix corculum, Walker, List Dipt. B.M., ii., 1849, p. 269.

Comptosia corculum, White, Proc. Roy. Soc. Tasm., 1916, p. 203. *Id.*, Hardy, Proc. Roy. Soc. Tasm., 1917, p. 66.

Neuria maculosa, Newman, Entom., i., 1841, p. 221.

Neuria partita, Newman, Entom., i., 1841, p. 221. *Id.*, Walker, Ins. Saund. Dipt., 1852, p. 167.

Comptosia geometrica, Macquart, Dipt. Exot., suppl. 2, 1847, p. 53. *Id.*, White, Proc. Roy. Soc. Tasm., 1916, p. 202.

Neuria geometrica, Walker, Ins. Saund. Dipt., 1852, p. 167.

Alyosia geometrica, Rondani, Archiv. per la Zool. iii., 1863, p. 54.

Comptosia tricellata, Macquart, Dipt. Exot., suppl. 2, 1847, p. 53, Pl. ii., fig. 6.

Neuria tricellata, Schiner, Reise Novara, 1868, p. 131.

Neuria obscura, Walker, Ins. Saund. Dipt., 1852, p. 167.

Anthrax obscura, Walker, Ins. Saund. Dipt., 1852, p. 176.

Comptosia calophthalma, Thomson, Eugenies Resa, 1868, p. 485.

Neuria hemiteles, Schiner, Reise Novara, 1868, p. 132.

Comptosia fulvipes, Bigot, Ann. Ent. Soc. France (7), lxi., 1892, p. 359.

Synonymy.—*Bibio sylvanus*, Fabricius, is described as a fuscous species with the scutellum and sides of the two first abdominal segments ferruginous; the wings have a subferruginous anterior border and several fuscous spots; the legs are piceous.

This description could apply to a species of the genus *Hyperalonia*, and evidently Walker's reference refers to such, or to a species until recently generally known as *Comptosia corculum*, some large specimens of which conform to this description far better than any known species of the genus *Hyperalonia*.

The type in the Banksian Collection was evidently collected at Botany Bay. The species here identified as *C. sylvanus*, Fabricius, is the commonest and most conspicuous Bombylid in that neighbourhood, and this fact, added to the comparatively good description, makes a plausible argument concerning the identity of Fabricius's species; on the other hand, specimens with the described ferruginous abdominal spots are rarely met with in this species.

Under the name *Comptosia sylvanus*, Fabricius, there are a number of specimens identified in various collections, and many of these have form names corresponding to special forms described, and are as follows:—

Form *corculum*, Newman, from Western Australia, is small, and has three submarginal cells.

Form *tricellata*, Macquart, is rather large, and comes from Mt. Wellington, Tasmania; it corresponds to the *C. corculum* of White and Hardy, and not to the original of that name by Newman. This form also has three submarginal cells.

Form *geometrica*, Macquart, from Tasmania, invariably has two submarginal cells, and occurs in low localities, never on the mountains.

Form *hermeteles*, Schiner, from Sydney, has three submarginal cells, but differs from all the others by the absence of the usual fuscous spots in the hyaline area of the wing.

The usual form of *C. sylvanus* in collections has three or two submarginal cells, and occurs on the eastern side of Australia. It was referred to by Schiner as *N. tricellata*, which must not be confused with Macquart's name; *C. calophthalma*, Thomson, is the same.

There is insufficient material in collections to judge the values cf *Neuria atherix*, *N. maculosa*, and *N. partita*, of Newman, or of *A. obscura*, Walker, and *C. fulvipes*, Bigot, but all these, from their descriptions, appear to be the same as the species here called *C. sylvanus*, Fabricius.

Much more material and information are required for the study of this species, but it seems certain that all the forms belong to one species, which varies somewhat under different conditions.

Comptosia plena, Walker.

Atherix plena, Walker, List. Dipt. B.M., ii., 1849, p. 270.

Neuria plena, Walker, Ins. Saund. Dipt., 1852, p. 167.

Note.—This very distinctive species, from Perth, Western Australia, resembles the previous only in having fuscous spots on the wing, and differs by the whole wings being more or less uniformly suffused greyish and slightly darker along the anterior border. A further but apparently undescribed species from New South Wales agrees in these characters, and must not be confused with the Western Australian form.

Comptosia fasciata, Fabricius.

Anthrax fasciata, Fabricius, Syst. Antl., 1805, p. 118. *Id.*, Wiedemann, Dipt. Exot., 1821, p. 150; and Auss. zweifl. Ins., i., 1828, p. 321. *Id.*, Walker, List Dipt. B.M., ii., 1849, p. 267.

Neuria fasciata, Walker, Ins. Saund. Dipt., 1852, p. 167. *Id.*, Schiner, Reise Novara, 1868, p. 129.

Comptosia fasciata, Hutton, New Zealand Dipt., 1881, p. 24.
Neuria nigricens, Newman, Entom., i., 1841, p. 221.

Synonymy.—*Anthrax fasciatus*, Fabricius, is described from the Pacific Islands. Walker refers *N. nigricens*, Newman, to the same name, and gives New Holland for locality. Schiner uses the name for specimens from New Zealand.

N. nigricens, Newman, is from near Sydney, and undoubtedly is the same as specimens identified here as *C. fasciata*, Fabricius.

Note.—The species is similar to *C. lateralis*, Newman, *C. albofasciata*, Thomson, and *C. apicalis*, Macquart. It differs from the last of these by the white spot of the wing being subapical instead of apical, and from the other two by the abdomen being not red laterally.

Comptosia lateralis, Newman

Neuria lateralis, Newman, Entom., i., 1841, p. 220. *Id.*, Walker, Ins. Saund. Dipt., 1852, p. 167. *Id.*, Schiner, Reise Novara, 1868, p. 131.
Anthrax insignis, Walker, List Dipt. B.M., ii., 1849, p. 266.

Synonymy.—Walker evidently changed the name of this species to *Anthrax insignis*, as *Anthrax lateralis* was preoccupied by Say in 1823; the species, however, belongs to the genus *Comptosia*, and in any case it cannot belong to the genus *Anthrax*.

White identified a specimen in Dr. Ferguson's collection as *C. fascipennis*, Macquart, which species is queried from Monte Video.

Note.—This species differs from the previous by the abdomen being bordered laterally with large separated, almost confluent reddish spots, and from the next species, *C. albofasciata*, Thomson, by the smaller size.

Comptosia albofasciata, Thomson.

Comptosia albofasciata, Thomson, Eugenies Resa, 1868, p. 484. *Id.*, Froggatt, Austr. Ins., 1907, p. 296, Pl. xxviii., fig. 5.

Note.—It is possible that this species is only a large form of *C. lateralis*, Newman.

Comptosia ducens, Walker.

Anthrax ducens, Walker, Ins. Saund. Dipt., 1850, p. 176.
Neuria ducens, Walker, *ibidem*, p. 167.

Neuria grandis, Schiner, Reise Novara, Dipt., 1868, p. 130.

Synonymy.—*A. ducens*, Walker, and *N. grandis*, Schiner, evidently belong to the same species, which varies remarkably in size. It differs from *C. albofasciata*, Thomson, and *C. lateralis*, Newman, by the absence of the white fascia on the wings.

Comptosia aurifrons, Macquart.

Comptosia aurifrons, Macquart, Dipt. Exot., suppl. 4, 1850, p. 113, Pl. x., fig. 16.

Note.—This is a very common species, which is easily recognised by the golden pubescence on the front. It is represented in most collections.

Hab.—New South Wales and Victoria.

Comptosia dorsalis, Walker.

Anthrax dorsalis, Walker, List Dipt. B.M., ii., 1849, p. 269.

Neuria dorsalis, Walker, Ins. Saund. Dipt., 1852, p. 167.

Comptosia quadripennis, Walker.

Anthrax quadripennis, Walker, List Dipt. B.M., ii., 1849, p. 268.

Neuria quadripennis, Walker, Ins. Saund. Dipt., 1852, p. 167. *Id.*, Froggatt, Austr. Ins., 1907, p. 297.

Note.—This species is similar to *C. apicalis*, Macquart, but has three instead of two submarginal cells.

Comptosia apicalis, Macquart.

Comptosia apicalis, Macquart, Dipt. Exot., suppl. 3, 1846, p. 35, Pl. iii., fig. 13.

Alyosia apicalis, Rondani, Arch. per la Zool., iii., 1863, p. 54.

Neuria apicalis, Schiner, Reise Novara, 1868, p. 132.

Note.—This species has the white fascia of the wings entirely covering the tip.

Comptosia sobria, Walker.

Anthrax sobria, Walker, List Dipt. B.M., ii., 1849, p. 269.

Neuria sobria, Walker, Ins. Saund. Dipt., 1852, p. 167.

Note.—In Dr. Ferguson's collection there are three specimens numbered respectively 62, 257, and 258, all from Sydney, which were identified by White as Walker's species. In general appearance they resemble *C. ducens*, Walker, but differ structurally by having an appendix in the form of a

recurrent vein on the upper branch of the cubital fork, and also the intermediate cross vein is situated rather close to the apex of the discal cell.

There are five further specimens in the Macleay Museum from New South Wales, and one of these is labelled "Wheeny "Creek, Jan. 8; Skuse."

Genus *Docidomyia*, White.

Docidomyia, White, Proc. Roy. Soc. Tasm., 1916, p. 203.

Docidomyia pueralis, White.

Docidomyia pueralis, White, Proc. Roy. Soc. Tasm., 1916, p. 204.

Hab.—Tasmania and New South Wales. This species is common on the sand-dunes of La Perouse, Botany Bay; specimens from this locality are, however, smaller than those examined from Tasmania.

Species Undetermined.

Comptosia moretonii, Dipt. Exot., suppl. 5, 1854, p. 77, Pl. iii., fig. 15.

Anthrax præargentata, Macleay, in King's Narr. Surv. Austr., ii., 1832, p. 468. *Id.*, Wiedemann, Auss. Zweifl. Ins., ii., 1830, p. 648. *Id.*, Walker, List Dipt. B.M., 1849, p. 268.

Neuria præargentata, Newman, Entom., i., 1841, p. 221. *Id.*, Walker, Ins. Saund. Dipt., 1852, p. 167.

(This species is possibly a true *Comptosia*, but no specimens in the collection under revision agree with the description.)

Anthrax basilis, Walker, List Dipt. B.M., ii., 1849, p. 267.

Neuria basilis, Walker, Ins. Saund. Dipt., 1852, p. 167.

Anthrax decedens, Walker, List Dipt. B.M., ii., 1849, p. 271.

Neuria decedens, Walker, Ins. Saund. Dipt., 1852, p. 167.

Anthrax stria, Walker, List Dipt. B.M., ii., 1849, p. 267.

Neuria stria, Walker, Ins. Saund. Dipt., 1852, p. 167.

Anthrax extensa, Walker, Ent. Mag., ii., 1835, p. 473. *Id.*, Walker, List Dipt. B.M. ii., 1849, p. 269.

Neuria extensa, Newman, Entom.. i., 1841, p. 221. *Id.*, Walker, Ins. Saund. Dipt., 1852, p. 167.

Anthrax serpentiger, Walker, List Dipt. B.M., ii., 1849, p. 270.

Comptosia bicolor, Macquart, Dipt. Exot., suppl. 4, 1850, p. 114, Pl. x., fig. 17.

Neuria bicolor, Schiner, Reise Novara, 1868, p. 131. (New Zealand.)

Neuria rufoscutellata, Jænnicke, Abhand. der Senkenb. naturf. G. vi., 1867, p. 345, Pl. xliii., fig. 9 (= ? *Comptosia ducens*, Walker.)

SYSTROPINÆ.

Note.—Four genera are placed in this subfamily, and each is represented by one species. The genus *Systropus* belongs here, and the other three genera are provisionally placed here, and have been placed and suggested in subfamilies as follows:—Genus *Antoniaustralia* in the subfamily *Tomoyzinæ*, *Marmasoma* in the *Toxophorinæ*, and *Eclimus* in the *Cylleniinæ*. Becker included the *Toxophorinæ* under the *Cylleniinæ*, and the two Australian species known are too closely related for them to be separated into different subfamilies.

Genus *Systropus*, Wiedemann.

Systropus, Wiedemann, Nov. Dipt. Gen., 1820, p. 18.

Status.—Under the subfamily *Systropinæ* Becker gives two genera which are characterised as follows:—*Systropus*, with contiguous eyes in both sexes and the abdomen club-form. *Dolichomyia*, with the eyes not contiguous in both sexes and the abdomen not club-form.

In the species described below the eyes are not contiguous in both sexes, and the abdomen is club-form in the male.

Systropus clavifemoratus, sp. nov. (Pl. XVII., figs. 16, 17, 18, and 19.)

Description.—A black and grey species with brownish yellow anterior and intermediate legs; the posterior legs are mostly black with partly yellow tibiæ, and the femora are swollen apically, and each has two rows of about ten ventral spines on the swollen part.

Male.—The head is dark grey with black eyes and vertex. The antennæ are black and short, about half the length of the head, and they contain a cylindrical first joint with short black hairs; the second joint is about half the length of the first; the third joint is compressed, apically pointed, and about as long as the first. The proboscis is black, about as long as the head, and the palpi are black, long, erect, and reach about as far as the upturned portion of the proboscis. The eyes are approximate near the black ocellar triangle and contiguous near the greyish antennal triangle. The face

between the antennæ and the oral margin is very small, and extends as a thin strip to the cheeks. The occiput is slightly concave above and very convex below; it contains a row of minute marginal bristles and sparse white pubescence.

The thorax is black dorsally and greyish laterally with a black lateral ridge, and is covered with sparse short whitish hairs. Ventrally the thorax is greyish with black on the sutures between the sclerites, and contains some very sparse whitish hairs, the most perceptible of which consist of two rows of minute whitish bristly hairs on the mesonotum, one of which is under the lateral ridge and the other on that portion adjacent to the roots of the wings.

The compressed abdomen is black, with tracings of greyish lateral markings and a grey venter; the abdomen widens apically, as is usual in the genus, and terminates in a rather complex genitalia.

All the legs have their coxæ greyish, and the remainder of the anterior and intermediate legs are brownish yellow, and are stained with fuscous at the base and on the tarsi; the pulvilli are yellow. The hind femora are black with the apical third swollen, and they contain a ventral yellowish brown mark at the base of the swollen part, and beyond this each has two parallel rows of about ten ventral spines. The hind tibiæ are yellow with the base and apex broadly black; the tarsi are black with the pulvilli yellowish.

The wings are hyaline, and the halteres obscure brownish.

Female.—The female is similar to the male, but differs by the eyes being separated and the front greyish, and also the abdomen is not perceptibly clubbed.

Length.—Male and female, 8 mm.

Hab.—New South Wales, Blue Mountains, Blackheath; two males and one female were taken on flowering shrubs on the 25th November, 1919.

Type.—The male holotype and the female allotype are in the Australian Museum.

Genus *Antoniaustralia*, Becker.

Antoniaustralia, Becker, Ann. Mus. Zool., St. Petersburg, xvii., 1912, p. 459.

Antoniaustralia hermanni, Becker.

Antoniaustralia hermanni, Becker, Ann. Mus. Zool., St. Petersb., xvii., 1912, p. 459, fig.

Note.—This species is not represented in the collections under revision.

Genus *Marmasoma*, White.

Marmasoma, White, Proc. Roy. Soc. Tasm., 1916, p. 188.

Marmasoma sumptuosa, White. (Pl. XVI., figs. 5, 6, and 7.)

Marmasoma sumptuosa, White, Proc. Roy. Soc. Tasm., 1916, p. 190.

Description.—Female. Similar to the male, eyes widely separated; the front is similar to the rest of the head in colour and vestiture, and contains about twelve black bristles; the abdomen is more conspicuously clothed with scales, and the apex contains a protruding lamella above.

Hab.—Tasmania, Brown's Cave Valley, off the Bagdad Valley. One male and one female allotype, taken on the 25th October, 1914.

Type.—The female allotype is in the Australian Museum.

Genus *Eclimus*, Loew.

Eclimus, Loew, Stett. Ent. Zeit., v., 1844, p. 154.

Note.—The Australian species placed in this genus is represented by a single specimen which has the antennæ apparently mutilated; it is possible that this character is the result of an abortion due to an agency acting during the pupal, or less likely the emerging from the pupal, stage. The insect was captured in this condition by the writer, and the extremely short third joint of the antennæ was noted at the time whilst the insect was still alive. Probably the normal form of the antennæ is similar to that of other species placed under the genus *Eclimus*.

Eclimus longipalpis, sp. nov. (Pl. XVII., figs. 13, 14, and 15.)

Description.—The male is a black insect with short black pile; the thorax and scutellum have a little depressed yellow pile, and the whole insect ventrally is greyish. The wings are hyaline with a small fuscous spot at the base of the cubital vein, and a large black area beyond the apical half of the wing reaching from the costa to the discal cell.

Male.—The head is black with a greyish tomentum covering the face reaching to the cheeks, and is traceable on the antennæ. The antennæ consist of a rather long first joint, the second joint is a quarter the length of the first, and the third joint is scarcely longer than the second, and the apex is truncate, receding from the dorsal to the ventral surface, and the edge appears to be crowned with minute spines; the character of the third joint is unlike that of a Bombylid, and may be due to an abortion as explained under the genus. The black proboscis is about twice

the length of the head, and the palpi, also black, reach to three-quarters the length of the proboscis. The eyes are contiguous near the ocellar triangle and slightly separated near the antennæ. In the oral aperture there is a pronouncedly rounded tubercle which contains a moustache of hairs which are white and predominantly black in colour. The face protrudes beyond the eyes, is free from hairs except on the cheeks, which contain a beard of long white hairs which merge into the long black hairs situated on the convex occiput and on the vertex.

The thorax dorsally contains a black vestiture of a velvety appearance and some black hairs; also there are some short depressed yellow hairs mostly confined to the median line. Ventrally some long white hairs are present, and are more abundant on the mesopleura. The scutellum is black and margined greyish, which colour extends to the humeral callus; depressed yellow pubescence is uniformly distributed and the lateral hairs are whitish.

The abdomen, containing nine segments, is velvety black, and the incisions mostly have white pile. From the third segment the depressed black pile becomes bristle-like, and on the last three segments these bristles are longer and more erect. Ventrally the abdomen is grey as far as the seventh segment and has long whitish hairs.

The legs are very long and black, sparsely covered with white tomentum; there are very long white hairs on the coxæ and femora, and very short black spines on the other segments.

The wings are hyaline, and have a large fuscous blotch, which is bounded by the costal vein, the upper cubital fork, the base of the second submarginal cell, half the length of the first posterior cell, the base of the second and third posterior cells, and from thence by a more or less direct line to the costa. There is a small spot at the base of the cubital vein. The halteres are obscure yellowish brown.

Length.—7 mm.

Hab.—New South Wales, Botany Bay, La Perouse. One male taken on a flowering shrub on the 8th December, 1918.

Type.—The unique male holotype is in the Australian Museum.

BOMBYLIINÆ.

Genus *Cyrtomorpha*, White.

Cyrtomorpha, White, Proc. Roy. Soc. Tasm., 1916, p. 185.

Cyrtomorpha paganica, White.

Cyrtomorpha paganica, White, Proc. Roy. Soc. Tasm., 1916, p. 186, fig. 30.

Hab.—Tasmania, Bellerive, near Hobart. Three specimens were collected on a coastal sand-dune on the 25th January, 1918; they were hovering over and settling on bare spaces amongst foliage, but owing to their small size they were extremely difficult to see even when settled on the bare patches.

Note.—White described the species from a single specimen which he considered to be a male; one of the three specimens examined has the male genitalia slightly exserted, and this determines the sex; the eyes are uniformly separated in all three specimens, and therefore probably all three specimens are males.

Genus *Geron*, Meigen.

Geron, Meigen, System. Beschreib., ii., 1920, p. 223. *Id.*, White, Proc. Roy. Soc. Tasm., 1916, p. 186.

Geron australis, Macquart.

Geron australis, Macquart, Dipt. Exot., ii. (1), 1840, p. 118, Pl. xiii., fig. 2.

Geron dispar, Macquart, Dipt. Exot., suppl. 4, 1850, p. 122, Pl. xi., fig 13. *Id.*, White, Proc. Roy. Soc. Tasm., 1916, p. 187.

Geron cothurnatus, Bigot, Ann. Soc. Ent. France (7), xli., 1892, p. 374.

Geron hilaris, White, Proc. Roy. Soc. Tasm., 1916, p. 188, text fig. 31.

Synonymy.—*Geron australis* is described from Port Jackson, and specimens from the locality and from New South Wales generally show a wide range of variation in size and characters, and there are no satisfactory characters whereby they can be divided into more than one species. Tasmanian specimens of *Geron dispar*, Macquart, are of a larger average size, but again show the same range of size, and cannot be divided from those of New South Wales. Specimens agreeing with the description of *Geron hilaris*, White, are represented in the collection under revision from New South Wales, but not from Tasmania, the type locality; nevertheless, there can be little doubt but that *G. hilaris*, White, does not represent a distinct species. *Geron cothurnatus*, Bigot, was placed as a synonym of *G. dispar*, Macquart, by White, and this is undoubtedly the correct position.

Hab.—New South Wales, Victoria, and Tasmania. This is one of the commonest species of the *Bombyliidæ*, is represented in most collections, and the dates range from November to April.

Genus *Acreotrichus*, Macquart.

Acreotrichus, Macquart, Dipt. Exot., suppl. 4, 1849, p. 121. *Id.*, Becker, Ann. Mus., St. Petersb., xvii., 1912, p. 488.

Acreotrichus gibbicornis, Macquart.

Acreotrichus gibbicornis, Macquart, Dipt. Exot., suppl. 4, 1849, p. 121, Pl. xi., fig. 11. *Id.*, Schiner, Reise Novara, 1868, p. 138. *Id.*, Froggatt, Austr. Ins., 1907, p. 297. *Id.*, Becker, Ann. Mus. Zool. St. Petersb., xvii., 1912, p. 488.

Acreotrichus fusicornis, Macquart, Dipt. Exot., suppl. 4, 1849, p. 122, Pl. xi., fig. 12. *Id.*, Froggatt, Austr. Ins., 1907, p. 207.

Acreotrichus inappendiculatus, Bigot, Ann. Soc. Ent. France (7), lxi., 1892, p. 366.

Synonymy.—*A. fusicornis*, Macquart, is the female of *A. gibbicornis*, Macquart; specimens have been taken in copula on many occasions, and thus the sex relationship has been established. Specimens in the Macleay Museum were labelled with their sexes denoted, and the label conveying the synonymy was probably written by Skuse or Masters.

The description of *A. inappendiculatus*, Bigot, was probably taken from a female—not a male as stated in the description—of this species.

Hab.—New South Wales; Sydney. This is the first species of Bombylid to appear in the spring, and it continues on the wing through the summer; it occurs everywhere where wild flowers are abundant, and at times twenty or thirty specimens can be taken with one sweep of the net, and indeed sometimes they are so abundant that they continuously divert one's attention from other insects.

Genus *Phthiria*, Meigen.

Phthiria, Meigen, Ill. Mag. Ins., ii., 1803, p. 268.

Phthiria hilaris, Walker. (Pl. XVI., fig. 8.)

Phthiria hilaris, Walker, Ins. Saund. Dipt., 1856, p. 194.

Phthiria lineifera, Walker, Trans. Ent. Soc. Lond., iv., 1857, p. 146.

Phthiria pallipes, Bigot, Ann. Soc. Ent. France (7), xli., 1892, p. 367.

Synonymy.—Apparently all the descriptions were taken from one variable species.

Description.—Female. A yellow and black species of very variable colour pattern; the eyes are widely separated.

Male.—This sex has not hitherto been described; it is of small size, and obscure black in colour with yellow markings restricted to the apex of the abdominal segments.

The head is black, the eyes are contiguous, the ocellar triangle is very small, and contains a little black pubescence; the antennal triangle and the face seen laterally stand prominently forward in front of the eyes. The antennæ are about as long as the head; the first joint is nearly twice the length of the second; the third joint is twice the length of the basal joints united and contains a minute subapical dorsal arista. The face, front, and antennæ as far as the middle of the third segment are covered with long black pubescence. The black pubescence on the cheeks extends into the black and yellow pubescence on the upper half of the occiput.

The thorax and scutellum are covered with a velvety black vestiture, and with long pubescence reflecting a whitish or reddish colour according to the angle at which it is viewed.

Dorsally the abdomen contains a velvety black vestiture, and the apices of the segments are margined yellow laterally; ventrally the abdomen is mostly yellow, but the bases of the last three segments and a pair of spots at the base of the two prior segments are black. The whole abdomen is covered with a similar pubescence to that of the thorax.

The legs are black; a pubescence similar to that on the thorax extends to the coxæ and femora, and merges into the fuscous pubescence on the tibiæ and tarsi.

The wings are hyaline, but there is a deep yellow tinge in the mediastinal cell.

Length.—Male, 5 mm.

Hab.—New South Wales; the allotype male, described above, was taken at Blackheath on the 25th November, 1919; there are three paratype males and six females from the same locality taken between the 16th and 25th November, 1919. Further specimens are represented in various collections under revision.

Victoria; Timboon, one female in the collection of Dr. Ferguson was collected by H. W. Davey.

Type.—The allotype male is in the Australian Museum.

Note.—The head characters read similar to those of *Acreotrichus gibbicornis*, Macquart, which differs, however, by the pubescence of the face being exceptionally long, and the third joint of the antennæ containing some long hairs on the apical half and little, if any, on the basal half. *Acreotrichus inappendiculatus*, Bigot, described from a specimen said to be a male cannot belong here, as the description conforms almost entirely to that of a female *A. gibbicornis*.

There are several apparently distinct species in the genera *Acreotrichus* and *Phthiria* in the collections under revision, and they show that their respective genera cannot be separated by the usual characters adopted. Those characters given by Bigot and Becker in their respective keys do not hold good for Australian species. The appendix of the upper branch of the cubital fork can be used as a somewhat imperfect guide, as it is rarely absent in *Acreotrichus* and never present on *Phthiria*. The females can be readily distinguished by the presence or absence, respectively, in these genera, of long thick pubescence on the front and face.

Genus *Dischistus*, Loew.

Dischistus, Loew, Neue Beitr., iii., 1855, p. 45. *Id.*, White, Proc. Roy. Soc. Tasm., 1916, p. 192 (in key).

Note.—It appears that the characters of *Sparnopolius limbatus*, Bigot, belong to those given to the genus *Dischistus* in the key, and on this account Bigot's species is placed under this genus.

Schiner states that a new genus will be required for *Dischistus crassilabris*, Macquart.

There are several undescribed species in various collections that come within the characters strictly attributed to the genus *Dischistus*, but until the positions of those already described can be ascertained it is inadvisable to add new descriptions that ultimately may cause further hindrance without benefiting the taxonomy of the group.

Dischistus crassilabris, Macquart.

Bombylius crassilabris, Macquart, Dipt. Exot., suppl. 5, 1854, p. 77, Pl. iv., fig. 1.

Dischistus crassilabris, Schiner, Novara Reise, 1868, p. 138.

Note.—This species is represented in various collections.

? *Dischistus limbatus*, Bigot.

Sparnopolius limbatus, Bigot, Ann. Soc. Ent. France (7), lxi., 1892, p. 369.

Note.—This species has not been recognised in the various collections under revision.

Genus *Systœchus*, Loew.

Systœchus, Loew, Neue Beitr., iii., 1855, p. 45. *Id.*, White, Proc. Roy. Soc. Tasm., 1916, p. 196.

Choristus, Walker, Ins. Saund. Dipt., 1852, p. 197.

Note.—There are fourteen names belonging to species that undoubtedly conform to the characters of the genus *Systœchus*, and of these only one has hitherto been placed in synonymy.

In the collections under revision three species are recognised as distinct, and conform in their characters to described species. A number of undoubtedly distinct species do not conform to the descriptions.

Systœchus platyurus, Walker. (Pl. XVI., fig. 9.)

Bombylius platyurus, Walker, List Dipt. B.M., ii., 1849, p. 286.

Bombylius crassus, Walker, *ibidem*, p. 287.

Systœchus crassus, White, Proc. Roy. Soc. Tasm., 1916, p. 196, text fig. 34.

Bombylius notatipennis, Macquart, Dipt. Exot., suppl. 5, 1854, p. 78, Pl. iv., fig. 2.

Bombylius punctipennis, Thomson, Eug. Resa, Dipt., 1868, p. 487.

Synonymy.—There appear to be three distinctive forms of this species; one, *B. platyurus*, Walker, from Western Australia, was placed by White as a synonym of the East Australian form, *B. crassus*, Walker. The Tasmanian form was described by White as *S. crassus*. The names given by Macquart and Thomson evidently belong to the same species.

Systœchus vetustus, Walker.

Bombylius vetustus, Walker. List Dipt., B.M., ii., 1849, p. 286.

Bombylius sericans, Macquart, Dipt. Exot., suppl. 4, 1850, p. 116, Pl. xi., fig. 3.

Bombylius penicillatus, Macquart, *ibidem*, p. 118, Pl. xi., fig. 7.

Systœchus pausarius, Jænnicke, Abhand. der Senck nat. G., vi., 1867, p. 348.

Systœchus callynthrophorus, Schiner, Reise Novara, 1868, p. 137.

Bombylius spinipes, Thomson, Eug. Resa, Dipt., 1868, p. 488.

Synonymy.—The above synonymy appears to be correct. The species is very common and very variable in size. In Dr. Ferguson's collection a female is labelled by White as *S. vetustus*, Walker, and a second female with fuscous spots traceable on the wings and with the front slightly wider is named *S. pencillatus*, Macquart. Macquart's description does not appear to agree with White's determination, as these characters are not mentioned; the length of the proboscis is too variable to be used for identification purposes, and therefore it seems advisable to consider Macquart's two names as belonging to probable variations of the same species.

Systœchus distinctus, Walker.

Bombylius distinctus, Walker, Ins. Saund. Dipt., 1850, p. 201.

Note.—Three males and one female from Sydney, in the Macleay Museum, probably belong here; the female has an exceptionally wide head, and both sexes are uniformly light brown in colour.

Systœchus albiceps, Macquart.

Bombylius albiceps, Macquart, Dipt. Exot., suppl. 3, 1848, p. 36.

Systœchus bifrons, Walker.

Choristus bifrons, Walker, Ins. Saund. Dipt., 1850, p. 198, Pl. v., fig. 5.

Systœchus leucopygus, v. d. Wulp.

Systœchus leucopygus, v. d. Wulp, Notes Leyden Mus., vii., 1883, p. 86.

Genus *Sisyromyia*, White.

Sisyromyia, White, Proc. Roy. Soc. Tasm., 1916, p. 197.

Note.—Under this genus seventeen descriptions are placed. Two of these White placed to synonymy, and five further synonyms are suggested here. Three species are definitely recognised in the collections under revision as belonging to described species, a fourth species is temporarily retained under a fourth name, and six descriptions by Walker have not been recognised.

Sisyromyia auratus, Walker.

Bombylius auratus, Walker, List Dipt. B.M., ii., 1849, p. 289.

Sisyromyia aurata, White, Proc. Roy. Soc. Tasm., 1916, p. 198.

Bombylius crassirostris, Macquart, Dipt. Exot., suppl. 4., 1850, p. 117, Pl. xi., fig. 5.

Bombylius albavitta, Macquart, Dipt. Exot., suppl. 4, 1850, p. 117, Pl. xi., fig. 4.

Bombylius loewii, Jænnicke, Abh. der Senck nat. G., vi., 1867, p. 345.

Bombylius pycnorhynchus, Thomson, Eug. Resa, Dipt., 1868, p. 486.

Bombylius lobalis, Thomson, *ibid.*, p. 487.

Bombylius scutellaris, Thomson, *ibid.*, p. 488.

Synonymy.—A very variable group of Bombylids, including a variety with sulphur-coloured hair, and another with deep red hair, appears to form a species to which the above descriptions agree; it is possible, however, that some of these descriptions will ultimately be found to belong to *Sisyromyia decoratus*, Walker, or an allied species.

Sisyromyia decoratus, Walker.

Bombylius decoratus, Walker; List Dipt., B.M., ii., 1849, p. 291.

Note.—This species was described from Western Australia, but a specimen identified by White is in Dr. Ferguson's collection, and was taken in New South Wales. The specimen does not agree very well with Walker's description, but nevertheless it is retained in this position until it can be compared with the Western Australian form. The anterior border of the wing is fuscous, and is sharply defined from the hyaline area of the wing, whilst in *S. auratus*, Walker, the darker area on the anterior border of the wing is suffused.

Sisyromyia brevirostris, Macquart.

Bombylius brevirostris, Macquart, Dipt. Exot., suppl 4, 1850, p. 119, Pl. xi., fig. 9. *Id.* (?), Walker, Ins. Saund. Dipt., 1850, p. 202.

Sisyromyia brevirostris, White, Proc. Roy. Soc. Tasm., 1916, p. 199.

Systœchus eulabiatus, Bigot, Ann. Soc. Ent. France (7), lxi., 1892, p. 366.

Synonymy.—The above synonymy is given on the authority of White.

Sisyromyia pinguis, Walker.

Bombylius pinguis, Walker, List Dipt. B.M., ii., 1849, p. 290.

Hab.—Western Australia; King George's Sound; one female in the Macleay Museum conforms to the description.

Sisyromyia altus, Walker.

Bombylius altus, Walker, List Dipt. B.M., ii., 1849, p. 288.

Sisyromyia antecedens, Walker.

Bombylius antecedens, Walker, *ibidem*, p. 293.

Sisyromyia immutatus, Walker.

Bombylius immutatus, Walker, *ibidem*, p. 292.

Sisyromyia primogenitus, Walker.

Bombylius primogenitus, Walker, *ibidem*, p. 292.

Sisyromyia rutilus, Walker.

Bombylius rutilus, Walker, *ibidem*, p. 289.

Sisyromyia tetratrichus, Walker.

Bombylius tetratrichus, Walker, *ibidem*, p. 291.

Genus *Bombylius*, Linnæus.

Bombylius, Linnæus, Syst. Nat. Edit., x., 1758, p. 606. *Id.*, White, Proc. Roy. Soc. Tasm., 1916, p. 192.

Note.—There are fourteen descriptions that apparently belong to the genus *Bombylius* in its restricted sense; of these seven are recognisable in the collections under revision, three probably belong to synonyms, and five have not been recognised.

Bombylius fuscanus, Macquart.

Bombylius fuscanus, Macquart, Dipt. Exot., suppl. 4, 1850, p. 119. *Id.*, White, Proc. Roy. Soc. Tasm., 1916, p. 193.

Note.—Under this species White suggests that Walker's *B. matutinus* is a synonym, but no species of the genus *Bombylius* is definitely known to occur both in Australia and Tasmania, although some species from these localities are very closely allied, and therefore the suggested synonymy is not accepted here. *B. fuscanus* is a dull uniformly coloured species.

Bombylius tenuicornis, Macquart.

Bombylius tenuicornis, Macquart, Dipt. Exot., suppl. 1, 1846, p. 116. *Id.*, White, Proc. Roy. Soc. Tasm., 1916, p. 192.

Bombylius matutinus, Walker, List Dipt. B.M., ii., 1849, p. 281.

Bombylius australianus, Bigot, Ann. Ent. Soc. France (7), lxi., 1892, p. 364.

Synonymy.—For the species allied to *B. fuscanus*, Macquart, the name *B. tenuicornis*, Macquart, is utilised. Macquart's localities are Australia and Tasmania, but the second locality was evidently taken from a species he described from Tasmania as *B. fuscanus*, four years later. *B. matutinus*, Walker, and probably *B. australianus*, Bigot, also belong here.

Note.—This species is of a uniform colour containing dense black and rather bright reddish pubescence; the descriptions by the various authors were taken from denuded specimens. The general appearance of the species is like that of *B. fuscanus*, but brighter in tone.

Bombylius viduus, Walker.

Bombylius viduus, Walker, Ins. Saund. Dipt., 1850, p. 199.

Bombylius palliolatus, White, Proc. Roy. Soc. Tasm., 1916, p. 194.

Synonymy.—White overlooked the description of *B. viduus*, Walker, which agrees with *B. palliolatus*, White, and is also from Tasmania.

Bombylius aureolatus, Walker.

Bombylius aureolatus, Walker, Trans. Ent. Soc. Lond., iv., 1857, p. 145.

Note.—This beautiful species is rather common round Sydney; it has three longitudinal silvery stripes on the abdomen and a pair of similar lateral stripes on the thorax.

Bombylius hilaris, Walker.

Bombylius hilaris, Walker, List Dipt. B.M., ii., 1849, p. 274.

Note.—This beautiful Western Australian species has a colour pattern which is well described by Walker.

Bombylius rubriventris, Bigot.

Bombylius rubriventris, Bigot, Ann. Ent. Soc. France (7), lxi., 1892, p. 365.

Note.—This species was described from Sydney, but two specimens from King George's Sound agree rather well with Bigot's description and belong to or near this species. There are six specimens in the Macleay Museum which belong to or near here, and these are labelled from Cape York, Queensland; another specimen is from South Australia. These specimens range from 10 mm. long, and have a yellowish pubescence on a reddish ground colour and a black stripe on the abdomen. The thorax is black on the specimens in the Macleay Museum.

Bombylius pictipennis, Macquart.

Bombylius pictipennis, Macquart, Dipt. Exot., suppl. 4, 1850, p. 118.

Hab.—New South Wales; Sydney, August, 1915, and Newcastle.

Note.—This species is represented by two male specimens, numbered 234 and 235, in Dr. Ferguson's collection, and they were named by White as *B. hilaris*, Walker, but they differ from Walker's species in the wing markings. Three further specimens are in the Macleay Museum.

Bombylius chrysendetus, White.

Bombylius chrysendetus, White, Proc. Roy. Soc. Tasm., 1916, p. 195.

Note.—This species is not represented in the collections under revision.

Bombylius nanus, Walker.

Bombylius nanus, Walker, List Dipt. B.M., ii., 1849, p. 278.

Note.—This species is not represented in the collections under revision. White compared his *B. chrysendetus* with it.

Bombylius albicinctus, Macquart.

Bombylius albicinctus, Macquart, Dipt. Exot., suppl. 2, 1847, p. 54.

Note.—This species, described from Tasmania, is not represented in the collections under revision.

Bombylius consobrinus, Macquart.

Bombylius consobrinus, Macquart, Dipt. Exot., suppl. 2, 1847, p. 54.

Note.—The description of this species is very inferior and short. It may be a small specimen of *B. tenuicornis*, Macquart, and moreover it is significant to note that the localities given by Macquart in both cases are "Australia and "Tasmania." It is probable that two species were mixed under one name, as a species of the genus is not definitely known from both localities.

Species of uncertain generic position.

Bombylius australis, Guerin, Voy. Coq. (2), ii., 1830, p. 294, Pl. xx., fig. 4.

Species erroneously recorded as Australian.

Exoprosopa collaris, Wiedemann. Kertesz (Cat. Dipt., v., 1909) gives "India or Australia" as localities for this species, but the latter locality was evidently intended for Africa. The species is placed as a synonym of *E. lar*, Fabricius, by Brunetti in the Fauna Brit. Ind., Dipt.-Brachycera, i., 1920.

Anthrax semiatra (Hoffmann), Macquart, Dipt. Exot., suppl. 4, 1850, p. 113. Hoffmann's species is referable to *Anthrax morio*, Linnæus, which is known from Europe and North America; Macquart recorded it from Australia.

CYRTIDÆ.

Characters.—The family contains a group of abnormal flies of diverse shapes. The head is composed almost entirely of eyes, and is situated well down on the thorax. The antennæ are minute or very large, and may be placed close to the mouth or as far up as near the summit of the head, and the eyes may be contiguous on either side or on both sides of the antennæ. The thorax and abdomen are usually inflated, the squama large, covering the halteres, and the wing venation may be rudimentary or complex.

Note.—The family contains at least seven described Australian species, which have been given twenty-four specific names. There are six genera recognised, and one of these, *Epicerina*, may be identical with the genus *Panops*. The species are generally rare, usually variable in colour, and the sexes so far ascertained are dimorphic.

In the present paper new species are not described, but an attempt is made to complete the synonymy of those already known, and to collect together a complete catalogue of references. The species have been well illustrated by various authors, and therefore figures are not given with this catalogue.

Key to the Genera of the family Cyrtidæ.

1. The antennæ very small and inconspicuous, and with a terminal style. 2.
   The antennæ large and conspicuous and without a terminal style; eyes bare. 4.
2. The costa of the wing curved forward and angulate; the eyes pubescent. *Pterodontia.*
   The costa of the wing normal. 3.
3. The venation more or less complete; the eyes pubescent. *Nothra.*
   The venation obscure and vestigial; the eyes bare. *Oncodes.*
4. The abdomen elongate and with the basal half strongly constricted. *Leucopsina.*
   The abdomen oval, or if elongate then constricted between each segment. 5.
5. The proboscis short. *Epicerina.*
   The proboscis long. *Panops.*

Genus *Pterodontia*, Gray.

Pterodontia, Gray, in Griff. Animal Kingd., xv., 1882, part 34, p. 779, Pl. cxxviii., fig. 3. *Id.*, White, Proc. Roy. Soc. Tasm., 1914, p. 68.

Characters.—The eyes are densely pubescent; the antennæ are very small and have a terminal style; the abdomen is bladder-form, *i.e.*, inflated, in appearance. The costa is curved forward and angulate at about four-fifths the length of the wing; the venation is complete, and the veins are comparatively few in number.

Type.—*P. flavipes*, Gray .. .. America.

Pterodontia mellii, Erichson.

Pterodontia flavipes, Macquart (*nec* Grey), Dipt. Exot., i. (2), 1838, p. 175; and ii. (1), 1840, Pl. i., fig. 2; and ii. (3), 1843, Pl. xxxiv., fig. 3 (preoccupied).

Pterodontia mellii, Erichson, Entomog., i., 1840, p. 163. *Id.*, Walker, List Dipt. B.M., vi., suppl. 2, 1854, p. 348. *Id.*, Westwood, Trans. Ent. Soc. Lond., 1876, p. 513. *Id.*, Froggatt, Austra. Ins., 1897, p. 297.

Pterodontia macquarti, Westwood, Trans. Ent. Soc. Lond., 1848, p. 97. *Id.*, Walker, List Dipt. B.M., vi., suppl. 2, p. 348. *Id.*, Westwood, Trans. Ent. Soc. Lond., 1876, p. 513.

Synonymy.—It seems certain that only one species of this genus has been described from Australia, and probably the species described by White as *P. variegata* is identical, but as specimens are not available for comparison the Tasmanian species is retained as distinct.

The name *P. macquarti*, Westwood, was created to take the place of the preoccupied *P. flavipes*, Macquart, but *P. mellii*, Erichson, takes priority.

Pterodontia variegata, Walker.

Pterodontia variegata, White, Proc. Roy. Soc. Tasm., 1914, p. 68, text fig. 10.

Status.—The holotype of this species is unique, and is in the collection of Mr. F. M. Littler. When a series of specimens is available for comparison this species will undoubtedly be found to be identical with *P. mellii*, Erichson.

Genus *Nothra*, Westwood.

Nothra, Westwood, Trans. Ent. Soc. Lond., 1876, p. 514.

Characters.—The eyes contain long conspicuous pubescence; the antennæ are situated near the mouth, are very small, and have a terminal style; the abdomen is bladder-form. The wings are normal in shape, and the veins are comparatively few in number and complete; the venation is similar to that of the genus *Pterodontia*.

Type.—*N. bicolor*, Westwood .. .. .. Australia.

Nothra bicolor, Westwood.

Nothra bicolor, Westwood, Trans. Ent. Soc. Lond., 1876, p. 515, Pl. vi., fig. 4.

Hab.—There are two specimens from South Australia in the Australian Museum.

Genus *Oncodes*, Latrielle.

Ogcodes, Latrielle, Precis caract. gen. d'Ins., 1796, p. 154.

Henops, Meigen, Ill. Mag. f. Ins., ii., 1803, p. 266.

Acrodes, Froggatt, Austr. Ins., 1897, p. 298.

Oncodes, White, Proc. Roy. Soc. Tasm., 1914, p. 69.

Characters.—The eyes are bare; the antennæ are situated near the mouth, which is vestigial, and are very small,

inconspicuous, and terminate in a style. The venation is very incomplete and rudimentary.

Type.—*O. gibbosus*, Linnæus .. .. Europe.

Oncodes basilis, Walker.

Henops basilis, Walker, Ins. Saund. Dipt., 1852, p. 203.

Oncodes basilis, Hardy, Proc. Roy. Soc. Tasm., 1917, p. 60.

Ogcodes darwinii, Westwood, Trans. Ent. Soc. Lond., 1867, p. 516.

Ogcodes fortumni, Westwood, *ibidem.*

Ogcodes ignava, Westwood, *ibidem.*

Ogcodes tasmanica, Westwood, *ibidem.*

Acrodes fumatus, Froggatt, Austr. Ins., 1897, p. 298.

Ogcodes doddi, Wandolleck, Trans. Ent. Soc. Lond., 1906, p. 131, figs.

Oncodes flavescens, White, Proc. Roy. Soc. Tasm., 1914, p. 70, text fig. 11. *Id.*, Hardy, Proc. Roy. Soc. Tasm., 1916, p. 267.

Oncodes nigrinervis, White, *ibidem*, 1914, p. 71.

Oncodes ater, White, *ibidem*, 1914, p. 72.

Oncodes pygmæus, White, *ibidem*, 1914, p. 72.

Synonymy.—The above synonymy has already been published (see Hardy, 1917), with the exception of *Acrodes fumatus*, Froggatt. Mr. Froggatt informs me that *Acrodes* is a misprint for *Oncodes; Oncodes fumatus* was used by Erichson for a European species, and it is unlikely that the Australian species is identical with it. Mr. Froggatt's description conforms to that of a male, and specimens in the Agricultural Department under his name are females.

Genus *Leucopsina*, Westwood.

Leucopsina, Westwood, Trans. Ent. Soc. Lond., 1876, p. 510.

Characters.—The eyes are bare; the antennæ are long, three jointed and without a terminal style, they are situated high up on the head, but are separated from the ocelli by the contiguous eyes. The face is linear, and the proboscis long. The wings are normal in shape, and have a rather complex and complete venation. The abdomen is elongate and club-form.

Type.—*L. odyneroides*, Westwood .. .. Australia.

Leucopsina odyneroides, Westwood.

Leucopsina odyneroides, Westwood, Trans. Ent. Soc. Lond., 1876, p. 510, Pl. v., fig. 3.

Genus *Epicerina*, Macquart.

Epicerina, Macquart, Dipt. Exot., suppl. 4, 1849, p. 97.

Characters.—The eyes are bare; the antennæ are long and without a style, they are situated near the ocelli; the proboscis is short; the abdomen is bladder-form. The wings have a rather complex venation similar to that of the genus *Panops*, Lamarck.

Type.—*E. nigricornis*, Macquart .. .. Tasmania.

Status.—The genus *Epicerina* differs from the genus *Panops* by the proboscis being short, and in other respects the generic characters agree. The genus is unknown in recent collections, but it is certain that it will not maintain its position as a separate genus when more is known concerning it.

Epicerina nigricornis, Macquart.

Epicerina nigricornis, Macquart, Dipt. Exot., suppl. 4, 1849, p. 98, Pl. ix., fig. 8. *Id.*, Hardy, Proc. Roy. Soc. Tasm., 1917, p. 61.

Genus *Panops*, Lamarck.

Panops, Lamarck, Ann. Mus. d'Hist. Nat., iii., 1804, p. 266, Pl. xxii., fig. 3.

Mesophysa, Macquart, Dipt. Exot., i. (2), 1838, p. 166.

Characters.—The eyes are bare; the antennæ are situated close to the ocelli, are long and without a terminal style; the proboscis is very long. The wings have the venation rather complex and complete. The abdomen in one species is bladder-form, in the other elongate and constricted between the segments.

Type.—*P. baudini*, Lamarck .. .. Australia.

Panops baudini, Lamarck.

Panops baudini, Lamarck, Ann. Mus. d'Hist. Nat., iii., 1804, p. 226, Pl. xxii., fig. 3. *Id.*, Lamarck, Hist. Nat. sans Vert., iii., 1806, p. 316. *Id.*, Latrielle, Ency. Meth., viii., 1811, p. 710. *Id.*, Latrielle, Dict. d' Hist. Nat., xxiv., p. 467. *Id.*, Wiedemann, Auss. Zweifl. Ins., ii., 1803, p. 19. *Id.*, Macquart, Hist. Nat. Dipt., i., 1834, p. 356. *Id.*, Erichson, Entomogr., i., 1840, p. 141. *Id.*, Walker, List. Dipt. B.M., vi., suppl. 2, 1854, p. 333.

Mesophysa marginatus, Macquart, Dipt. Exot., i. (2), 1838, p. 168.

Mesophysa australasiæ, Thomson, Eug. Resa, Dipt., 1868, p. 475.

Panops lamarckanus, Westwood, Trans. Ent. Soc. Lond., 1876, p. 508, Pl. v., fig. 1.

Synonymy.—According to the descriptions *Panops baudini*, Lamarck, and *Mesophysa marginatis*, Macquart, were described from male specimens, and *Mesophysa australasiæ*, Thomson, and *Panops lamarckianus*, Westwood, were described from female specimens; all belonging to the same species.

Hab.—New South Wales, Sydney. A pair of specimens in the Macleay Museum bear a label conveying the information that they were taken on Sydney Swamp, and that they are the two sexes of the same species, which is identified as *Panops baudini*, Lamarck. The identification appears to be correct. There are two further specimens in the Macleay Museum, and two in the Australian Museum.

Panops flavipes, Latrielle.

Panops flavipes, Latrielle, Ency. Meth., viii., 1811, p. 710. *Id.*, Lamarck, Hist. Nat. sans Vert., iii., 1816, p. 412. *Id.*, Wiedemann, Auss. Zweifl. Ins., ii., 1830, pp. 20 and 649. *Id.*, Erichson, Entom., i., 1840, p. 141. *Id.*, Walker, List Dipt. B.M., vi., suppl. 2, 1854, p. 333. *Id.*, Froggatt, Austr. Ins., 1897, p. 297.

Mesophysa scapularis, Macquart, Dipt. Exot., i. (2), 1838, p. 167.

Hab.—New South Wales and Victoria.

Note.—The specimens examined are invariably males, which suggests that only the distinctive males have been recognised, and the females may be normal to the genus in shape, and either confused with *Panops baudini*, Lamarck, or may have been placed under another genus such as *Epicerina nigricornis*, Macquart.

LIST OF WORKS.

This list only contains taxonomic works; it includes works containing the original generic descriptions and all those dealing with genera and species described from Australia.

Becker. St. Petersburg.—Academie imperiale des Sciences. Musee Zoologique. Annals xvii., 1912.

Bergroth. Stettiner Entomologische Zeitung, lv., 1894.

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ILLUSTRATIONS.

Plate XVI.

Fig. 1. Genus *Hyperalonia;* the antennæ showing a large and well-defined apical style.

Fig. 2. Genus *Anthrax;* the antennæ of a form with a small apical style.

Fig. 3. *Argyramœba maculata,* Macquart; the antennæ showing the typical pencil of hairs at the apex which is to be seen in all species of the genus.

Fig. 4. Genus *Comptosia;* the antennæ.

Fig. 5. *Marmasoma sumptuosa,* White; the head of the male seen from the front.

Fig. 6. *Marmasoma sumptuosa,* White; the head of the female seen laterally.

Fig. 7. *Marmasoma sumptuosa,* White; the head of the female seen from the front.

Fig. 8. *Phthiria hilaris,* Walker; the head of the male seen laterally.

Fig. 9. *Systœchus platyurus,* Walker; the antennæ drawn from a Tasmanian specimen.

Plate XVII.

Fig. 10. *Lomatia sobricula,* Walker; a portion of the wing showing the contortion of the radial vein.

Fig. 11. *Oncodocera ampla,* Walker; a portion of the wing showing the contortion of the radial vein.

Fig. 12. *Comptosia sylvana,* Fabricius; a portion of the wing showing the contortion of the radial vein.

Fig. 13. *Eclimus longipalpis, sp. nov.*

Fig. 14. *Eclimus longipalpis;* the head seen from the front.

Fig. 15. *Eclimus longipalpis;* the wing.

Fig. 16. *Systropus clavifemoratus, sp. nov.*

Fig. 17. *Systropus clavifemoratus;* the head of the male.

Fig. 18. *Systropus clavifemoratus;* the head of the female.

Fig. 19. *Systropus clavifemoratus;* the wing.

THE COMPLETION OF THE GENERAL MAGNETIC SURVEY OF AUSTRALIA BY THE CARNEGIE INSTITUTION OF WASHINGTON.

By

CAPT. EDWARD KIDSON, O.B.E., M.Sc.

[Originally written for the Hobart-Melbourne Meeting of the Australasian Association for the Advancement of Science, January, 1921.]*

(Read before the Royal Society of Tasmania, 8th August, 1921.)

The plan of the General Magnetic Survey of Australia by the Department of Terrestrial Magnetism of the Carnegie Institution of Washington was explained in a paper read by the author before the Australasian Association at Melbourne in 1913. As there stated, the object was to secure approximately one station for every 10,000 square miles of territory, or about 300 stations in all, with a uniform distribution over the Continent. Lack of facilities for travelling over large areas of the interior, of course, prevented the execution of this plan in its entirety, but the number and distribution of the stations established by the close of the survey in November, 1914, may be considered very satisfactory under the circumstances.

The finally accepted results are given in the appended table, which is self explanatory. Some have already been published in the volumes of the Department of Terrestrial Magnetism, where descriptions of stations will also be found, but some have not yet appeared in print.

I was assisted at various times during the progress of the work by the following observers:—F. Brown, F. W. Cox, A. L. Kennedy, W. C. Parkinson, and E. N. Webb. In the last column of the Table of Results the observer respon-

*Owing to the Shipping Strike, the meeting of the A.A.A.S., which was to have been held in Hobart, had to be held in Melbourne. As a consequence, numerous difficulties had to be overcome. It was found impossible to bring out the ordinary Report of the A.A.A.S. meeting and print all papers. Arrangements were made for certain papers to be read before the Society, and printed in the Papers and Proceedings for 1921.

sible for the observations is shown by his initials. When observations were made jointly by two observers, this fact is shown by the combination of their last initials.

A number of the expeditions made by members of the party entailed a considerable amount of organisation, and work was carried on under conditions which were frequently arduous and occasionally dangerous. The more important of these expeditions were:—(a) One carried out by myself from Wiluna to Hall's Creek, in Western Australia, along the disused Canning Stock Route; (b) Expeditions by Mr. Brown down the Yorke Peninsula, and by launch along the north coast of the Coburg Peninsula (N.T.); (c) A journey by Mr. Parkinson by Ford motor along the No. 1 Rabbit Proof Fence in Western Australia; (d) Mr. Kennedy's camel trip along the line of the transcontinental railway from Port Augusta. Short accounts of these expeditions, as well as of the instrumental equipment, will be published in the works of the Department of Terrestrial Magnetism.

On my journey along the Canning Stock Route an earth inductor was used extensively in the field for the first time, and gave excellent results, without any mishaps, proving itself far superior to the dip-circle.

Towards the end of 1914 the party was concentrated at Perth, and outstanding computations were finished up and instruments compared. The writer then returned to Washington, and other members of the party were assigned to work in other countries. A comparison at Washington between the Department standard instruments and some of those used in Australia gave a final check on the Australian observations. The various comparisons with standard instruments in Washington before and after going to the field, and between instruments while in the field, gave very satisfactory results. With the exception of dip-circles, the needles of which are apt to become slightly rusted, and less accurate in consequence, the instrumental corrections for the various elements remained small, and almost constant.

Considerable assistance was received in the execution of the work by all members of my party from the Government officials in each State.

Station.	Date.	Lat. S.	Long. E.	Declination	Dip. S.	Horizontal Intensity.	Obs'r.
						C.G.S	
Thursday Island, B	Oct. 21, 1912	10 34.5	142 13	4 59.0E	..	..	FWC
Thursday Island, C	Oct. 21, 1912	10 34.5	142 13	4 59.4E	..	..	FWC
Thursday Island, A	Oct. 10, 1912	10 34.9	142 12	4 54.6E	33 18.8	.36892	K&C
	Oct. 11, 1912	..	..	4 57.1E	..	..	K&C
	Nov. 7, 1913	..	..	4 56.4E	33 25.7	.36863	FB
Albany Island.. ..	Oct. 18, 1912	10 43.9	142 36	5 05.2E	33 28.2	.36762	EK
Mapoon Mission ..	Nov. 15, 1913	11 57.8	141 53	4 58.9E	35 48.9	.36528	FB
	Nov. 22, 1913	..	..	4 57.8E	..	..	FB
	Nov. 23, 1913	..	..	4 56.8E	..	..	FB
Connell's Creek ..	Sep. 23, 1912	12 17.4	131 33	3 25.6E	37 46.9	.36210	EK
Port Darwin	Sep. 27, 1912	12 26.7	130 50	3 23.4E	38 10.5	.36229	K&C
	Sep. 30, 1912	..	..	3 23.8E	..	..	K&C
	Oct. 1, 1912	..	..	3 23.2E	..	..	K&C
Weipa Mission ..	Dec. 1, 1913	12 44.6	142 10	5 03.6E	37 08.6	.36328	FB
Batchelor	Sep. 14, 1912	13 03.6	131 03	3 29.5E	39 06.0	.35910	K&C
Mien	Dec. 8, 1913	13 12.8	142 49	5 13.0E	37 47.2	.36216	FB
Pine Creek	Sep. 11, 1912	13 49.6	131 51	3 28.2E	40 19.4	.35655	EK
Coen	Dec. 12, 1913	13 57.2	143 12	5 22.6E	38 57.6	.36005	FB
Katherine River ..	Sep. 4, 1912	14 26.1	132 17	3 38.4E	41 14.3	.35585	EK
Leech's Billabong..	Aug. 31, 1912	14 44.1	132 52	3 42.7E	41 29.7	.35464	EK
Musgrave	Dec. 17, 1913	14 47.4	143 31	5 26.2E	40 14.6	.37748	FB
Elsey Creek	Aug. 26, 1912	15 06.2	133 08	3 41.9E	42 00.9	.35356	EK
Cooktown	Nov. 26, 1912	15 28.6	145 17	5 49.4E	41 00.2	.35539	K&C
	Dec. 23, 1913	..	..	5 51.6E	41 05.3	.35484	FB
Laura	Nov. 21, 1912	15 33.2	144 30	5 40.8E	41 19.8	.35480	K&C
	Nov. 22, 1912	..	..	5 44.6E	..	.35463	K&C
	Nov. 22, 1912	..	..	..	..	.35406	K&C
	Nov. 23, 1912	..	..	..	..	.35446	K&C
	Nov. 23, 1912	..	..	..	..	.35424	K&C
Laura, Secondary..	Nov. 22, 1912	15 33.2	144 30	5 42.4E	..	..	FWC
No. 3 Well	Aug. 23, 1912	15 38.0	133 13	3 46.0E	42 46.4	.35188	EK
Daly Waters	Aug. 14, 1912	16 19.8	133 25	3 53.4E	..	.35032	EK
	Aug. 15, 1912	..	..	..	43 56.0	..	EK
Milner's Well. ..	Aug. 13, 1912	16 41.5	133 26	3 56.7E	44 39.4	.34795	EK
Cairns	Nov. 18, 1912	16 55.6	145 46	5 59.6E	43 04.8	.35206	EK
Frew's Ponds.. ..	Aug. 11, 1912	16 58.8	133 27	4 05.6E	..	.34609	EK
	Aug. 12, 1912	..	..	..	45 10.6	..	EK
Chillagoe	Nov. 14, 1912	17 10.0	144 34	5 47.0E	43 47.6	.34918	EK
Newcastle Waters..	Aug. 9, 1912	17 23.0	133 26	3 48.0E	45 47.3	.34214	EK
Newcastle Waters, Secondary	Aug. 9, 1912	17 23.0	133 26	3 46.9E	..	..	EK
Normanton	Nov. 4, 1912	17 41.4	141 06	5 25.8E	45 01.1	.34558	EK
Burketown	Oct. 28, 1912	17 45.1	139 28	5 12.8E	45 20.4	.34707	K&C
	Nov. 1, 1912	..	..	..	45 19.5	..	K&C
Anthony Lagoon ..	Oct. 4, 1913	17 58.9	135 31	4 23.6E	46 17.6	.34193	FB
Powell's Creek.. ..	Aug. 3, 1912	18 04.8	133 41	3 54.8E	46 29.9	.34108	EK
Powell's Creek, Secondary	Aug. 5, 1912	18 04.8	133 41	3 42.4E	..	..	EK
Croydon	Nov. 6, 1912	18 13.1	142 15	5 35.4E	45 35.3	.34464	K&C
Croydon, Secondary	Nov. 7, 1912	18 13.1	142 15	5 31.5E	..	..	FWC
Cardwell..	Dec. 3, 1912	18 15.8	146 02	..	45 19.6	..	FWC
	Dec. 4, 1912	..	..	6 10.3E	..	.34332	FWC
Renner Spring ..	Aug. 1, 1912	18 19.2	133 48	4 00.8E	46 54.2	.34021	EK
Forsayth	Nov. 11, 1912	18 35.1	143 38	5 43.9E	45 59.8	.34270	K&C
Mooketa Rock Hole	July 30, 1912	18 38.0	133 54	..	47 20.1	..	EK
	July 31, 1912	..	..	3 58.5E	..	.33946	EK
Brunette Downs ..	Oct. 6, 1913	18 38.7	133 55	..	47 08.6	..	FB
	Oct. 7, 1913	..	..	4 08.0E	..	.34028	FB
Attack Creek	July 28, 1912	19 00.9	134 10	4 07.6E	..	.33785	EK
	July 29, 1912	..	..	..	47 43.0	..	EK
Alexandria	Oct. 2, 1913	19 04.0	186 39	4 18.0E	47 28.0	.33870	FB
	Oct. 2, 1913	..	..	..	..	.33836	FB
Townsville	Nov. 29, 1912	19 14.6	146 50	..	46 31.3	..	FWC
	Nov. 30, 1912	..	..	6 35.4E	..	.34142	FWC
	Nov. 24, 1913	..	..	6 39.6E	46 35.4	.34059	EK
Canobie	Nov. 20, 1913	19 28.3	140 57	5 58.0E	47 28.8	.33686	EK
Tennant's Creek . .	July 26, 1912	19 33.4	134 15	4 00.0E	48 25.6	.33475	EK
Mount Samuel.. ..	July 24, 1912	19 43.0	134 11	..	49 40.2	..	EK
	July 25, 1912	..	..	3 48.8E	..	.33286	EK

Station.	Date.	Lat. S.	Long. E.	Declination.	Dip. S.	Horizontal Intensity.	Obs'r.
						C.G.S	
Camooweal	Sep. 30, 1913	19 55.6	138 06	4 27.0E	48 39.6	.33608	FB
	Oct. 1, 1913	..	..	4 24.4E	..	.33655	FB
Bowen	Nov. 10, 1913	20 00.8	148 15	6 44.0E	47 32.8	.34111	EK
	Nov. 11, 1913	..	..	..	47 36.9	..	EK
Charters Towers ..	Nov. 13, 1913	20 04.4	146 15	6 31.4E	47 29.9	.33887	EK
Gilbert Creek.. ..	July 22, 1912	20 11.8	134 14	..	49 25.8	..	EK
	July 23, 1912	..	..	3 54.8E	..	.33212	EK
Wycliffe Well	July 20, 1912	20 41.4	134 15	3 57.5E	50 07.9	.33009	EK
Cloncurry	Oct. 13, 1913	20 42.4	140 30	4 50.6E	49 32.5	.33626	FB
Richmond	Nov. 17, 1913	20 45.2	143 09	5 45.5E	49 03.8	.33396	EK
Hughenden	Nov. 15, 1913	20 50.4	144 12	6 05.4E	49 06.2	.33282	EK
Mackay	Nov. 7, 1913	21 08.8	149 11	7 13.2E	48 54.9	.33237	EK
Taylor's Crossing..	July 18, 1912	21 14.8	134 08	3 32.6E	50 59.1	.32446	EK
Barrow Creek	July 15, 1912	21 32.0	133 53	3 33.4E	51 21.1	.32506	EK
Mount Douglas....	Oct. 30, 1913	21 32.2	146 51	6 50.2E	49 32.0	.33110	EK
Kynuna	Oct. 15, 1913	21 34.6	141 56	5 46.8E	50 33.5	.32786	FB
Urandangi	Sep. 27, 1913	21 36.9	138 20	4 48.6E	..	.32642	FB
	Sep. 28, 1913	..	..	4 44.7E	50 49.2	.32636	FB
Hanson's Well.. ..	July 10, 1912	21 47.8	133 39	..	51 46.6	..	K&C
	July 11, 1912	..	..	3 38.6E	..	.32294	K&C
Teatree Well	July 9, 1912	22 08 3	133 23	3 39.7E	52 10.8	.32012	K&C
St. Lawrence.. ..	Nov. 4, 1913	22 20.8	149 32	7 31.1E	50 33.6	.32704	EK
Winton	Oct. 17, 1913	22 24.1	143 03	6 09.2E	51 23.5	.32288	FB
	Oct. 18, 1913	..	..	6 04.7E	..	.32197	FB
Eastmere	Oct. 22, 1913	22 29.7	145 53	6 37.4E	51 22.3	.32435	EK
Ryan's Well	July 6, 1912	22 43.4	133 21	4 03.3E	53 03.2	.32000	EK
Clermont	Oct. 25, 1913	22 49.2	147 38	7 04.2E	51 02.8	.32532	EK
Boulia	Sep. 24, 1913	22 54.7	139 56	5 38.0E	52 19.6	.31987	FB
Burt Well	July 4, 1912	23 13.0	133 45	3 43.6E	53 30.8	.31406	EK
Winnecke's..	July 1, 1912	23 19.7	134 15	..	53 12.4	..	EK
	July 2, 1912	..	..	4 12.3E	..	.31974	EK
Rockhampton	Sep. 6, 1913	23 22.0	150 30	..	51 12.5	..	FB
	Sep. 8, 1913	..	..	8 00.6E	..	.32542	FB
Arltunga	June 29, 1912	23 26.2	134 41	3 47.7E	53 35.8	.31728	K&C
Arltunga, Secondary	June 29, 1912	23 26.2	134 41	3 45.0E	..	..	K&C
Longreach	Sep. 11, 1913	23 26.4	144 15	6 22.6E	52 33.6	.31903	K&B
Emerald	Sep. 9, 1913	23 30.8	148 10	7 18.9E	52 26.0	.31874	FB
Vergemont..	Sep. 17, 1913	23 31.5	143 02	6 03.6E	52 56.4	.31770	FB
	Sep. 17, 1913	..	..	6 08.0E	..	.31775	FB
Mayne Jn. Hotel..	Sep. 19, 1913	23 32.1	141 23	5 54.6E	53 21.9	.31431	FB
Jericho	Oct. 15, 1913	23 35.7	146 08	..	52 45.3	..	EK
	Oct. 16, 1913	..	..	6 39.8E	..	.31780	EK
Alice Springs	June 22, 1912	23 40.8	133 54	3 45.0E	54 05.0	.31286	EK
Alice Springs, Secondary	June 22, 1912	23 40.8	133 54	3 41.8E	..	..	EK
Gladstone	Oct. 4, 1913	23 51.0	151 15	8 08.0E	..	.31982	EK
	Oct. 6, 1913	..	..	..	52 05.7	..	EK
Temple Bar..	June 19, 1912	23 56.4	133 57	..	54 30.2	..	EK
	June 20, 1912	..	..	3 50.7E	..	.31107	EK
Ooraminna Well..	June 18, 1912	24 21.2	134 04	3 55.4E	54 55.8	.30939	EK
Stonehenge	Sep. 13, 1913	24 21.2	143 18	6 05.8E	53 53.4	.31382	K&B
Bedourie	Sep. 22, 1913	24 21.6	139 29	5 24.0E	54 37.1	.30864	FB
Rolleston	Oct. 13, 1913	24 27.8	148 37	7 13.2E	53 50.8	.31196	EK
Malvern Bore.. ..	Oct. 17, 1913	24 30.8	144 59	6 41.0E	53 51.2	.31427	EK
Alice Well	June 15, 1912	24 47.4	134 09	..	55 39.8	..	EK
	June 16, 1912	..	..	4 01.9E	..	.30504	EK
Tambo	Aug. 8, 1913	24 53.3	146 16	..	54 02.4	..	EK
	Aug. 9, 1913	..	..	6 53.7E	..	.31305	EK
Currawilla	Aug. 16, 1913	25 08.4	141 20	5 41.8E	55 04.9	.30848	K&B
Horseshoe Bend ..	June 13, 1912	25 11.1	134 15	3 43.6E	..	.30384	EK
	June 14, 1912	..	..	..	56 00.8	..	EK
Windorah	Aug. 14, 1913	25 25.4	142 39	6 07.7E	55 14.8	.30764	K&B
Crown Point	June 12, 1912	25 30.2	134 24	4 02.4E	56 15.9	.30238	EK
Maryborough	Sept. 3, 1913	25 32.0	152 42	..	54 01.7	..	FB
	Sept. 4, 1913	..	..	8 35.8E	..	.31210	FB
Gayndah	Oct. 8, 1913	25 37.7	151 37	8 12.0E	54 04.8	.31050	EK
Goyder Creek.. ..	June 10, 1912	25 38.4	134 39	3 49.2E	56 35.8	.30087	EK
Taroom	Sep. 30, 1913	25 38.8	149 48	7 51.7E	54 27.8	.31024	EK
Adavale	Aug. 12, 1913	25 54.8	144 35	6 29.2E	55 36.8	.30533	K&B

Station.	Date.	Lat. S.	Long. E.	Declination.	Dip. S.	Horizontal Intensity. C.G.S	Obs'r.
Charlotte Waters..	June 7, 1912	25 55.9	134 55	..	56 57.5	..	EK
	June 8, 1912	..	..	3 57.0E	..	.29916	EK
Blood's Creek	June 5, 1912	26 18.8	135 06	4 23.8E	57 23.6	.29500	EK
Charleville..	Aug. 7, 1913	26 24.4	146 14	7 03.8E	56 01.0	.30459	K&B
Roma	Aug. 5, 1913	26 34.0	148 48	7 40.2E	55 40.7	.30541	K&B
Meekatharra	Apr. 20, 1912	26 35.2	118 30	..	59 01.9	..	EK
	Apr. 21, 1912	..	..	1 05.5W	..	.28162	EK
Meekatharra, Secondary	Apr. 22, 1912	26 35.2	118 30	1 00.9W	..	..	EK
Eromanga	Aug. 19, 1913	26 40.1	143 16	6 24.6E	56 40.2	.30013	K&B
Woodgate's Swamp	Jun. 2, 1912	26 40.6	135 29	..	57 32.4	..	EK
	Jun. 3, 1912	..	..	4 06.0E	..	.29678	EK
Chinchilla	Aug. 2, 1913	26 44.6	150 38	8 19.4E	55 45.1	.30412	EK
Box Tree Flat	May 31, 1912	27 10.4	135 30	4 29.5E	58 14.2	.29299	EK
Brisbane	July 17, 1913	27 27.0	153 02	9 03.8E	56 09.9	.30154	EK
Brisbane University	Nov. 29, 1913	27 28.7	153 02	9 14.3E	..	.30135	EK
	Nov. 30, 1913	..	..	9 12.4E	..	..	EK
	Dec. 1, 1913	..	..	..	56 15.1	..	EK
Toowoomba	Jul. 23, 1913	27 32.8	151 57	8 30.4E	56 20.4	.30120	EK
Oodnadatta	Aug. 21, 1911	27 33.1	135 28	4 10.4E	58 26.5	.29177	K&W
	May 26, 1912	..	..	4 11.2E	58 32.5	.29190	EK
Southport	Jul. 19, 1913	27 58.7	153 26	9 02.8E	56 39.2	.29868	EK
Sandstone	Apr. 27, 1912	27 59.0	119 15	1 02.8W	60 27.0	.27261	EK
Thargomindah . ..	Aug. 21, 1913	27 59.7	143 49	6 38.0E	58 10.5	.29319	K&B
Mount Magnet, B*	Apr. 24, 1912	28 02.3	117 49	44 24.3E	64 16.2	..	EK
	Apr. 25, 1912	..	..	52 15.1E	..	.28884	EK
Mount Magnet, C*	Apr. 24, 1912	28 02.3	117 49	21 29.2E	72 10.5	..	EK
Mount Magnet, D*	Apr. 24, 1912	28 02.4	117 49	9 41.9E	64 32.3	..	EK
Mount Magnet, E*	Apr. 24, 1912	28 02.5	117 49	13 14.7E	63 40.0	..	EK
Mount Magnet, E*	Apr. 25, 1912	..	..	13 11.2E	..	.23764	EK
Mount Magnet, F*	Apr. 25, 1912	28 02.5	117 49	4 28.0E	..	..	EK
Mount Magnet, A*	Apr. 23, 1912	28 04.3	117 51	1 28.0W	60 44.6	.27078	EK
Cunnamulla	Aug. 23, 1913	28 04.3	145 42	6 57.1E	58 02.5	.29365	K&B
Lawlers	May 1, 1912	28 05.2	120 30	0 22.6W	61 06.6	.27288	EK
Lawlers, Secondary	May 1, 1912	28 05.2	120 30	0 11.0E	..	..	EK
Yalgoo	Apr. 18, 1912	28 20.6	116 40	..	60 48.6	..	EK
	Apr. 19, 1912	..	..	1 45.6W	..	.27246	EK
Goondiwindi	Jul. 26, 1913	28 32.0	150 18	9 10.2E	57 57.5	.29395	EK
Dirranbandi	Jul. 25, 1913	28 34.0	148 13	7 49.6E	58 11.9	.29263	EK
Laverton	Mar. 28, 1912	28 37.5	122 26	0 41.6W	61 17.3	.27534	EK
Boorthanna	Aug. 17, 1911	28 37.7	135 53	3 33.2E	59 37.3	.28571	K&W
Byron Bay	May 9, 1913	28 39.2	153 36	9 17.7E	57 29.8	.29444	EK
Geraldton	Apr. 16, 1912	28 47.0	114 37	..	61 57.5	..	EK
	Apr. 17, 1912	..	..	3 27.2W	..	.26196	EK
Tenterfield	Apr. 24, 1913	29 04.3	152 02	9 04.0E	58 02.2	.29304	EK
Mingenew	Apr. 15, 1912	29 12.4	115 26	3 50.9W	62 32.8	.25848	EK
Coward Springs ..	Aug. 18, 1911	29 24.2	136 49	4 01.0E	60 24.7	.28078	K&W
	Aug. 18, 1911	..	..	..	60 25.2	..	K&W
Moree	May 27, 1913	29 28	149 50	8 30.1E	59 06.3	.28741	EK
Hergott Springs ..	Aug. 16, 1911	29 39.1	138 02	5 13.8E	60 29.9	.28010	K&W
Menzies	Mar. 29, 1912	29 41.0	121 04	1 21.0W	..	.26174	EK
	Mar. 30, 1912	..	..	..	62 32.0	..	EK
Menzies, Secondary*	Mar. 30, 1912	29 41.0	121 04	1 10. W	..	..	EK
Wanaaring	Jun. 14, 1913	29 42.3	144 08	7 01.3E	59 51.8	.28252	EK
Milparinka	Jun. 21, 1913	29 45.0	141 54	6 24.8E	60 13.4	.28097	EK
Walgett	May 29, 1913	30 01.2	148 08	8 11.9E	59 46.9	.28255	EK
Farina, B.	Aug. 24, 1911	30 04.3	138 16	6 01.8E	..	..	ENW
Farina, A.	Aug. 23, 1911	30 04.5	138 17	5 50.8E	..	.27752	K&W
Farina, Secondary .	Aug. 23, 1911	30 04.5	138 17	..	60 54.2	..	ENW
Bourke	Jun. 11, 1913	30 05.0	145 57	7 33.3E	..	.28058	EK
	Jun. 12, 1913	..	..	..	60 10.5	..	EK
Bourke, 1	Jun. 12, 1913	30 05.0	145 57	7 29.7E	..	..	EK
Woolgoolga	May 5, 1913	30 07.2	153 12	9 19.9E	59 09.3	.28592	EK

*Local disturbance. The two declinations at Station Mount Magnet B were obtained at points less than 1 foot apart, showing great disturbance.

Station.	Date.	Lat. S.	Long. E.	Declination.	Dip. S.	Horizontal Intensity.	Obs'r.
						C.G.S	
Narrabri	May 28, 1913	30 18.6	149 48	8 47.0E	59 58.4	.28166	EK
Armidale..	Apr. 23, 1913	30 31.4	151 41	9 10.6E	59 45.6	.28248	EK
Moora	Apr. 12, 1912	30 38.0	115 59	4 39.0W	63 48.2	.25132	EK
Beltana	Aug. 25, 1911	30 48.3	138 24	5 32.4E	..	.27247	K&W
	Aug 26, 1911	..	..	..	61 34.2	..	K&W
Beltana, Secondary	Aug. 25, 1911	30 48.3	138 24	..	61 35.6	..	EK
Coonamble	Jun. 6, 1913	30 57.1	148 24	8 41.1E	..	.27829	EK
	Jun. 7, 1913	..	..	..	60 45.8	..	EK
Coolgardie	Mar. 26, 1912	30 57.2	121 11	1 30.6W	63 28.9	.25616	EK
Boorabbin	Mar. 20, 1912	31 12.8	120 20	2 01.0W	63 59.1	.25316	EK
Southern Cross .	Mar. 19, 1912	31 13.8	119 21	2 13.7W	64 06.0	.25142	EK
Werris Creek . .	Apr. 22, 1913	31 21.0	150 39	8 53.0E	61 04.2	.27540	EK
Nanwoora	Sep. 26, 1911	31 22.5	131 34	2 04.1E	62 29.5	.26962	EK
White Wells . . .	Sep. 27, 1911	31 26.1	130 59	2 29.3E	..	.26826	EK
	Sep. 28, 1911	..	..	..	62 55.8	..	EK
Port Macquarie .	Apr. 16, 1913	31 26.3	152 55	8 55.6E	60 46.6	.27770	EK
Diamond Drill Tank	Sep. 29, 1911	31 27.4	129 33	..	63 12.3	..	EK
	Sep. 30, 1911	..	..	1 06.0E	..	.26450	EK
Cundalabbie Tanks	Oct. 4, 1911	31 27.5	130 20	2 35.2E	..	.26109	EK
	Oct. 5, 1911	..	..	..	63 30.6	..	EK
Merredin	Mar. 17, 1912	31 28.3	118 19	3 23.0W	..	.25024	EK
	Mar. 18, 1912	..	..	..	64 19.6	..	EK
Cobar	Jun. 26, 1913	31 29.9	145 49	7 41.1E	..	.27282	EK
	Jun. 27, 1913	..	..	..	61 36.2	..	EK
Wilcannia	Jun. 16, 1913	31 33.7	143 23	6 59.6E	61 59.6	.27005	EK
Wilcannia, 1 . .	Jun. 23, 1913	31 33.7	143 23	6 59.3E	..	..	EK
Nyngan	Jun. 28, 1913	31 34.0	147 11	7 13.8E	61 26.0	.27260	EK
Colona	Oct. 7, 1911	31 37.6	132 05	3 02.9E	63 33.3	.25977	EK
Northam	Mar. 15, 1912	31 38.6	116 41	4 30.0W	64 43.4	.24453	EK
Eucla	Oct. 2, 1911	31 43.8	128 53	1 44.4E	63 32.0	.25951	EK
Broken Hill Reservoir . . .	Sep. 7, 1911	31 53.2	141 37	5 48.2E	62 35.5	.26606	ENW
Hawker	Aug. 29, 1911	31 53.2	138 26	5 50.4E	63 05.2	.26244	ENW
Bayswater, A .	Feb. 14, 1912	31 55.2	115 55	4 41.6W	64 51.4	.24422	EK
Bayswater, B† . .	Feb. 14, 1912	31 55.2	115 55	6 02.8W	..	..	EK
Bayswater, C† . .	Feb. 14, 1912	31 55.2	115 55	4 45.8W	..	..	EK
Yalata Head Station	Oct. 9, 1911	31 56.3	132 20	2 50.8E	63 55.7	.25600	EK
Broken Hill . . .	Sep. 10, 1911	31 57.8	141 27	6 18.1E	62 30.2	.26710	ENW
Perth	Feb. 16, 1912	31 58.0	115 50	4 45.0W	64 55.1	.24356	EK
Rottnest Island .	Feb. 17, 1912	32 00.2	115 33	4 38.1W	..	.24293	EK
	Feb. 18, 1912	..	..	..	65 01.6	..	EK
Cockburn	Sep. 4, 1911	32 05.1	141 00	6 14.8E	..	.26446	ENW
	Sep. 5, 1911	..	..	..	62 32.0	..	ENW
Ceduna	Sep. 21, 1911	32 08.2	133 36	3 50.6E	63 47.4	.25785	EK
Norseman	Mar. 23, 1912	32 12.2	121 48	1 29.6W	64 46.8	.24743	EK
Dubbo, A	Jun. 9, 1913	32 14.3	148 35	7 08.4E	61 38.0	.27941	EK
Dubbo, 1*	Jun. 9, 1913	32 14.8	148 35	4 05.1E	..	..	EK
Dubbo, B*	Jun. 30, 1913	32 14.9	148 37	8 47.5E	62 09.9	.26979	EK
Olary	Sep. 2, 1911	32 17.1	140 20	6 10.2E	63 32.4	.25706	ENW
Menindie	Jun. 18, 1913	32 23.9	142 26	6 50.4E	63 02.3	.26412	EK
Quorn	Aug. 14, 1911	32 31.4	138 02	6 09.8E	63 33.8	.26034	K&W
Yunta	Sep. 1, 1911	32 35.2	139 33	6 01.8E	63 23.6	.26119	ENW
	Sep. 11, 1911	..	..	6 01.6E	..	..	ENW
East Maitland . .	Apr. 21, 1913	32 44.9	151 34	9 34.1E	62 04.3	.26980	EK
Flinders	Sep. 18, 1911	32 47.9	134 11	3 15.6E	64 16.6	.25712	EK
Ivanhoe	May 22, 1913	32 54.2	144 19	7 17.5E	63 17.5	.26258	EK
Narrogin	Mar. 5, 1912	32 55.8	117 10	5 21.5W	..	.23530	EK
	Mar. 6, 1912	..	..	..	66 06.6	..	EK
Petersburg	Sep. 13, 1911	32 58.4	138 48	5 42.8E	63 58.6	.25708	ENW
Condobolin . . .	Jun. 4, 1913	33 04.8	147 09	..	63 02.2	..	EK
	Jun. 5, 1913	..	..	7 51.8E	..	.26402	EK
Port Pirie, A . .	Sep. 15, 1911	33 11.3	138 01	6 21.0E	..	.25894	ENW
	Sep. 16, 1911	..	..	6 18.5E	64 01.4	..	ENW
Port Pirie, B . .	Sep. 16, 1911	33 11.3	138 01	6 24.0E	..	.25833	ENW
Orange	Jun. 3, 1913	33 17.6	149 07	9 10.2E	63 02.6	.26304	EK

†Artificial local disturbance.

*Local disturbance.

Station.	Date.	Lat. S.	Long. E.	Declination.	Dip. S.	Horizontal Intensity.	Obs'r.
						C.G.S	
Talia	Sep. 15, 1911	33 19.2	134 50	4 15.2E	64 59.8	.25051	EK
Bunbury	Feb. 21, 1912	33 19.5	115 38	..	66 08.0	..	EK
	Feb. 22, 1912	..	..	5 46.3W	..	.23542	EK
Hillston	May 23, 1913	33 30.0	145 33	7 47.8E	63 40.6	.25977	EK
Burra	Aug. 11, 1911	33 40.7	138 55	6 00.6E	64 26.6	.25452	K&W
Cowell	Sep. 22, 1911	33 40.9	136 54	3 52.1E	65 01.0	.25108	ENW
Katanning	Mar. 4, 1912	33 41.3	117 33	4 21.8W	66 34.2	.23369	EK
Red Hill, A . . .	Mar. 4, 1913	33 44.5	151 04	..	63 12.2	..	EK
	Mar. 6, 1913	..	..	9 21.0E	..	.26249	EK
Red Hill, B . . .	Mar. 3, 1913	33 44.5	151 04	9 22.1E	..	.26234	EK
	Mar. 4, 1913	..	..	9 20.0E	..	.26220	EK
Garden Island . .	Mar. 28, 1913	33 51.9	151 14	9 35.9E	63 17.0	.26200	EK
Wallaroo	Sep. 19, 1911	33 56.3	137 36	5 49.2E	65 00.1	.26578	ENW
Bridgetown . . .	Feb. 23, 1912	33 57.4	116 09	5 35.2W	66 42.7	.23097	EK
Morgan	Oct. 26, 1911	34 02.5	139 40	6 21.2E	64 57.8	.25077	EK
Mount Hope . . .	Sep. 12, 1911	34 06.3	135 20	4 24.2E	..	.24677	EK
	Sep. 13, 1911	..	..	..	65 23.9	..	EK
Renmark	Oct. 28, 1911	34 10.1	140 45	6 31.3E	65 00.7	.25074	EK
Port Wakefield . .	Oct. 11, 1911	34 10.6	138 10	..	65 48.9	..	ENW
	Oct. 12, 1911	..	..	5 46.1E	..	.24690	ENW
Mildura	Nov. 1, 1911	34 11.8	142 11	6 43.4E	64 48.0	.25280	EK
Hay	May 20, 1913	34 30.5	144 51	7 41.0E	64 45.2	.25189	EK
Harden	Feb. 24, 1913	34 33.7	148 22	8 53.0E	64 15.4	.25498	EK
Port Lincoln . . .	Sep. 9, 1911	34 42.6	135 48	3 26.0E	66 00.0	.24406	EK
Narrandera . . .	May 17, 1913	34 44.3	146 34	8 23.3E	64 41.4	.25224	EK
Goulburn	Feb. 26, 1913	34 45.8	149 44	9 08.2E	64 19.7	.25440	EK
Adelaide (Botanical Park)	Oct. 18, 1911	34 55.3	138 37	5 35.2E	66 04.8	.24280	ENW
Adelaide (South Park) .	Aug. 8, 1911	34 56.2	138 36	5 37.0E	66 05.4	.24319	K&W
Albany	Mar. 1, 1912	35 01.3	117 55	..	67 16.8	..	EK
	Mar. 2, 1912	..	..	5 14.8W	..	.22910	EK
Edithburgh	Oct. 1, 1911	35 05.9	137 46	5 10.4E	66 24.8	.23940	ENW
	Oct. 2, 1911	..	..	5 05.6E	..	..	ENW
Wagga Wagga . .	Feb. 22, 1913	35 06.2	147 23	8 13.2E	64 57.3	.25027	EK
Murray Bridge .	Aug. 4, 1911	35 07.2	139 16	5 36.3E	..	.24091	K&W
Murray Bridge, Secondary . . .	Aug. 4, 1911	35 07.2	139 16	..	66 17.3	..	K&W
Pinnaroo	Oct. 26, 1911	35 15.8	140 55	6 04.1E	65 50.8	.24421	ENW
Mt. Pleasant . . .	Apr. 29, 1913	35 18.0	149 10	9 18.2E	64 48.3	.25150	EK
Mt. Stromlo* . . .	Apr. 28, 1913	35 19.5	149 00	8 47.1E	64 54.2	.25092	EK
Mt. Stromlo (1)* .	Apr. 28, 1913	35 19.5	149 00	9 26.7E	..	..	EK
Mt. Stromlo (2)* .	Apr. 28, 1913	35 19.5	149 00	9 41.3E	..	..	EK
Swan Hill	Jan. 21, 1913	35 20.2	143 34	7 19.7E	65 43.1	.24570	FWC
Port Victor . . .	Sep. 29, 1911	35 31.8	138 37	5 46.8E	66 36.6	.23758	ENW
Deniliquin	Jan. 27, 1913	35 32.0	144 58	8 02.4E	65 42.9	.24586	FWC
Woomelang . . .	Nov. 2, 1911	35 41.0	142 41	7 03.8E	66 11.5	.24292	EK
Coonalpyn . . .	Aug. 3, 1911	35 41.9	139 53	5 46.6E	66 21.7	.24044	K&W
Hog Bay	Oct. 8, 1911	35 43.2	137 56	5 12.8E	67 01.4	.23459	ENW
Harvey's Return .	Oct. 6, 1911	35 43.7	136 39	4 32.3E	66 59.8	.23406	ENW
Moruya	Mar. 17, 1913	35 55.1	150 05	8 10.8E	65 04.5	.25200	EK
Albury	Dec. 15, 1911	36 05.1	146 55	8 30.5E	65 58.4	.24359	EK
Echuca	Jan. 24, 1913	36 06.4	144 44	7 50.7E	66 17.2	.24182	FWC
Cooma	Mar. 12, 1913	36 14.0	149 08	9 24.2E	65 47.2	.24476	EK
Charlton	Jan. 17, 1913	36 16.6	143 22	6 59.0E	66 36.0	.23959	FWC
Border Town . .	Aug. 2, 1911	36 18.5	140 46	6 26.4E	67 02.9	.23616	K&W
Shepparton . . .	Jan. 30, 1913	36 22.6	145 24	8 15.7E	66 23.9	.24096	FWC
Horsham	Aug. 1, 1911	36 43.0	142 12	7 21.2E	67 08.4	.23555	K&W
Bendigo	Jan. 15, 1913	36 44.4	144 19	7 50.0E	66 52.0	.23699	FWC
Mansfield	Feb. 11, 1913	37 02.9	146 07	8 28.7E	66 55.9	.23658	FWC
Eden	Mar. 14, 1913	37 04.6	149 56	9 57.4E	66 21.8	.24044	EK
Omeo	Feb. 5, 1913	37 06.3	147 36	8 50.9E	66 45.5	.23748	FWC
Ararat	Jul. 31, 1911	37 17.0	142 57	7 26.8E	67 22.2	.23343	K&W
Ballarat	Jan. 2, 1913	37 34.0	143 50	..	67 57.5	..	FWC
	Jan. 3, 1913	..	..	6 50.0E	..	.22998	FWC
Casterton	Dec. 28, 1912	37 35.0	141 25	7 16.0E	..	.22758	FWC
	Dec. 29, 1912	..	..	7 15.9E	68 06.8	.22792	FWC

*Local disturbance.

Station.	Date.	Lat. S.	Long. E.	Declination.	Dip. S.	Horizontal Intensity. C.G.S	Obs'r.
Casterton, Secondary . . .	Dec. 30, 1912	37 35.0	141 25	7 15.9E			FWC
Water's Homestead	Feb. 15, 1913	37 40.0	146 07	8 38.0E	67 28.9	.23268	K&C
Bairnsdale	Feb. 3, 1913	37 49.5	147 39	9 07.6E	67 28.9	.23312	FWC
Melbourne, A . .	Jul. 19, 1911	37 49.9	144 58	8 05.4E	..	.23094	K&W
	Jul. 21, 1911	..	..	8 04.6E	..	.23108	K&W
	Jul. 21, 1911	..	..	8 07.6E	..	.23087	K&W
	Jul. 22, 1911	..	..	8 07.3E	..	.23101	K&W
	Apr. 4, 1913	..	..	8 03.9E	..	.23099	EK
	Apr. 5, 1913	..	..	8 04.7E	..	.23100	EK
	Apr. 6, 1913	..	..	8 02.3E	..	.23072	EK
	Apr. 6, 1913	..	..	8 05.6E	..	.23090	EK
	Apr. 7, 1913	..	..	8 01.7E	..	.23083	EK
	Apr. 9, 1913	..	..	..	..	.23104	EK
	Apr. 9, 1913	..	..	..	..	.23084	EK
Melbourne, B . . .	Jul. 18, 1911	37 49.9	144 58	8 06.0E	..	.23111	K&W
	Jul. 19, 1911	..	..	8 05.6E	..	.23085	K&W
	Jul. 20, 1911	..	..	8 04.4E	..	.23099	K&W
	Jul. 24, 1911	..	..	8 04.2E	..	.23096	K&W
	Jul. 24, 1911	..	..	8 07.6E	..	.23103	K&W
	Jul. 25, 1911	..	..	8 04.1E	..	.23123	K&W
	Feb. 1, 1912	..	..	..	67 42.7	..	EK
	Feb. 2, 1912	..	..	..	67 43.1	..	EK
	Apr. 4, 1913	..	..	8 05.0E	..	.23096	EK
	Apr. 5, 1913	..	..	8 04.5E	..	.23102	EK
	Apr. 6, 1913	..	..	8 02.5E	..	.23082	EK
	Apr. 6, 1913	..	..	8 05.6E	..	.23102	EK
	Apr. 7, 1913	..	..	8 01.2E	..	.23095	EK
	Apr. 8, 1913	..	..	..	67 42.5	..	EK
Melbourne, Dip Pier	Dec. 11, 1911	37 49.9	144 58	..	67 44.3	..	EK
	Dec. 11, 1911	..	..	..	67 44.7	..	EK
	Dec. 11, 1911	..	..	..	67 44.4	..	EK
	Feb. 1, 1912	..	..	..	67 44.3	..	EK
	Feb. 2, 1912	..	..	..	67 43.1	..	EK
	Apr. 7, 1913	..	..	..	67 43.1	..	EK
	Apr. 8, 1913	..	..	..	67 43.3	..	EK
Melbourne, Earth Inductor Pier .	Feb. 2, 1912	37 49.9	144 58	..	67 42.1	..	EK
Geelong	Dec. 17, 1912	38 09.0	144 23	..	68 02.7	..	EK
	Dec. 18, 1912	..	..	7 52.0E	..	.22771	EK
Geelong, Secondary . . .	Dec. 17, 1912	38 09.0	144 23	7 58.3E	..	..	EK
Portland	Dec. 24, 1912	38 20.6	141 37	..	68 44.8	..	FWC
	Dec. 26, 1912	..	..	6 30.2E	..	.22226	FWC
	Dec. 26, 1912	..	..	..	..	.22238	FWC
Portland, Secondary . . .	Dec. 24, 1912	38 20.6	141 37	6 49.0E	..	..	FWC
Warrnambool . . .	Dec. 21, 1912	38 23.6	142 29	7 10.4E	68 30.6	.22378	K&C
Warrnambool, Secondary . . .	Dec. 21, 1912	38 23.6	142 29	7 03.7E	..	..	FWC
Alberton	Jan. 11, 1913	38 37.4	146 40	9 00.7E	68 08.5	.22764	FWC
Beech Forest . . .	Dec. 19, 1912	38 37.5	143 34	..	68 31.4	..	EK
	Dec. 20, 1912	..	..	7 33.4E	..	.22358	*EK
Longford	Dec. 22, 1913	41 35.9	147 08	9 22.4E	..	.20610	EK
	Dec. 23, 1913	..	..	..	70 40.0	..	EK
Dee Bridge . . .	Dec. 26, 1913	42 17.8	146 40	8 47.2E	71 21.8	.20091	EK
Sorell	Dec. 30, 1913	42 47.6	147 33	9 46.5E	71 22.2	.20090	EK
Hobart, A*	Nov. 13, 1911	42 52.0	147 22	7 46.3E	..	.19597	JMB
	Nov. 14, 1911	..	..	7 38.8E	..	.19576	JMB
	Nov. 15, 1911	..	..	..	71 53.1	..	EK
	Nov. 15, 1911	..	..	..	71 53.1	..	EK
	Nov. 16, 1911	..	..	..	71 53.9	..	EK
	Nov. 17, 1911	..	..	7 45.1E	71 53.9	..	K&W
	Nov. 17, 1911	..	..	7 43.7E	71 53.5	..	K&W
	Nov. 18, 1911	..	..	7 44.2E	..	.19590	JMB
	Nov. 20, 1911	..	..	..	..	.19594	EK
	Nov. 20, 1911	..	..	..	..	.19594	ENW

*Local disturbance.

Station.	Date.	Lat. S.	Long. E.	Declination.	Dip. S.	Horizontal Intensity.	Obs'r.
						C.G.S	
Hobart, A*	Nov. 20, 1911	..	..	..	..	.19606	W&K
	Nov. 21, 1911	..	..	..	..	.19590	EK
	Nov. 21, 1911	..	..	..	..	.19610	W&K
Hobart, B*	Nov. 13, 1911	42 52.0	147 22	6 45.2E	..	.19268	ENW
	Nov. 14, 1911	..	..	6 37.6E	..	.19260	ENW
	Nov. 15, 1911	..	..	..	72 17.8	..	ENW
	Nov. 15, 1911	..	..	..	72 17.4	..	ENW
	Nov. 16, 1911	..	..	..	72 19.4	..	ENW
	Nov. 18, 1911	..	..	6 42.4E	..	.19274	ENW
Hobart, C*	Nov. 13, 1911	42 52.0	147 22	8 26.2E	..	.19760	EK
	Nov. 14, 1911	..	..	8 18.0E	..	.19756	EK
	Nov. 18, 1911	..	..	8 23.0E	..	.19763	EK
Thursday Island, A	Nov. 12 1915	10 34.9	142 12	4 56.9E	33 27.7	.36780	WCP
Cape Croker	Aug. 12, 1914	10 58.4	132 32	..	35 23.3	..	FB
	Aug. 13, 1914	..	..	3 42.2E	..	.36721	FB
Cape Wessel	Aug. 30, 1914	11 00.7	136 45	4 08.4E	34 51.4	.36698	FB
Cape Wessel, Secondary	Aug. 30, 1914	11 00.7	136 45	4 07.1E	..	..	FB
Piper Head	May 6, 1914	11 16.3	130 23	3 10.1E	36 08.3	.36590	FB
Brenton Bay	Sep. 13, 1914	11 18.4	131 13	..	36 06.3	..	FB
	Sep. 14, 1914	..	..	3 26.7E	..	.36643	FB
Cape Cockburn	Aug. 17, 1914	11 20.4	132 52	3 58.7E	36 01.2	.36540	FB
Bowen Straits Aboriginal Stn.	Sep. 11, 1914	11 20.6	132 33	3 47.6E	36 09.9	.36592	FB
	Sep. 11, 1914	..	..	..	..	.36578	FB
Victoria	Aug. 10, 1914	11 22.5	132 08	3 27.6E	36 23.7	.36566	FB
Bynoe	May 9, 1914	11 45.3	130 40	..	37 02.2	..	FB
	May 10, 1914	..	..	3 24.8E	..	.36341	FB
Mission Station, Bathurst Island	May 4, 1914	11 45.5	130 39	3 27.4E	37 01.5	.36340	FB
Bromby's Islands	Sep. 2, 1914	11 51.9	136 34	4 10.1E	36 24.2	.36476	FB
Bromby's Islands, Secondary	Sep. 2, 1914	11 51.9	136 34	4 08.3E	..	..	FB
Alger Island	Sep. 6, 1914	11 53.6	135 57	4 06.6E	36 37.4	.36472	FB
	Sep. 6, 1914	..	..	..	..	.36470	FB
Twenty Mile Landing	Aug. 20, 1914	11 54.7	133 24	3 43.0E	36 53.0	.36444	FB
Cape Hotham	Jul. 16, 1914	12 04.0	131 16	3 22.6E	37 24.5	.36346	FB
Cadell's Landing	Aug. 22, 1914	12 06.3	134 11	3 52.0E	37 07.5	.36416	FB
Cadell's Landing, Secondary	Aug. 22, 1914	12 06.3	134 11	3 50.8E	..	..	FB
Connell's Creek	Jul. 31, 1914	12 17.4	131 32	..	37 51.2	..	FB
	Aug. 1, 1914	..	..	3 28.4E	..	.36180	FB
Goyder River	Aug. 25, 1914	12 18.7	135 13	3 59.2E	37 20.6	.36308	FB
	Aug. 25, 1914	..	..	..	..	.36329	FB
Goyder River, Secondary	Aug. 25, 1914	12 18.7	135 13	4 02.0E	..	..	FB
Oenpelli	Jul. 25, 1914	12 19.8	133 02	3 49.6E	37 31.6	.36587	FB
	Jul. 26, 1914	..	..	3 49.4E	..	.36600	FB
Oenpelli, Secondary	Jul. 26, 1914	12 19.8	133 02	3 44.9E	..	..	FB
Cahill's Landing	Jul. 24, 1914	12 21.4	132 57	..	..	.36246	FB
	Jul. 27, 1914	..	..	3 51.4E	37 34.9	.36253	FB
Point Charles Lighthouse	Oct. 3, 1914	12 23.4	130 39	..	38 05.2	..	FB
	Oct. 4, 1914	..	..	3 25.4E	..	.36212	FB
	Oct. 6, 1914	..	..	..	38 03.3	..	FB
Point Charles Lighthouse, Secondary	Oct. 3, 1914	12 23.4	130 39	3 27.1E	..	..	FB
Arnhem Bay	Sep. 4, 1914	12 26.6	136 03	4 08.0E	37 25.6	.36300	FB
Darwin	May 19, 1914	12 26.7	130 50	3 25.2E	38 11.4	.36178	FB
Batchelor	May 14, 1914	13 03.6	131 03	3 30.4E	..	.35870	FB
	May 15, 1914	..	..	..	39 06.6	..	FB
Pine Creek (Playford)	Apr. 28, 1914	13 49.6	131 51	3 34.0E	40 07.4	.35757	FB
Pine Creek, B	Apr. 29, 1914	13 49.6	131 51	3 33.6E	40 10.2	.35772	FB

*Local disturbance.

Station.	Date.	Lat. S.	Long. E.	Declination	Dip. S.	Horizontal Intensity. C.G.S	Obs'r.
Katherine River .	Apr. 25, 1914	14 26.1	132 17	3 41.8E	41 14.1	.35508	FB
Mission Station, Roper River . .	Jun. 8, 1914	14 44.9	134 50	4 02.5E	41 21.0	.35624	FB
Port George IV. .	Sep. 24, 1914	15 21.1	124 43	2 18.8E	..	.34792	WCP
	Sep. 26, 1914	..	..	..	43 34.4	..	WCP
Victoria River . .	Apr. 8, 1914	15 24.5	130 02	3 08.0E	43 03.0	.35099	FB
Six Mile Hotel . .	Sep. 20, 1914	15 29.8	128 08	2 59.2E	..	.34868	EK
	Sep. 21, 1914	..	..	..	43 29.5	..	EK
Sir Edward Pellew Islands	Jun. 23, 1914	15 35.1	136 43	4 20.7E	42 21.7	.35319	FB
Depot, Victoria River	Apr. 13, 1914	15 37.0	130 27	3 18.0E	43 25.2	.34964	FB
Timber Creek . .	Apr. 14, 1914	15 38.1	130 29	3 19.1E	43 26.0	.34929	FB
Delamere	Apr. 19, 1914	15 44.1	131 32	3 30.9E	43 18.8	.35025	FB
Cheese Tin . . .	Sep. 17, 1914	15 49.8	128 20	2 54.5E	43 56.1	.34800	EK
Montgomery Islands	Sep. 29, 1914	15 53.7	124 18	2 14.4E	44 39.0	.34404	WCP
Black Rocks . .	Jun. 22, 1914	15 56.4	136 31	4 16.4E	43 04.6	.35151	FB
Five Mile Bar . .	Jun. 17, 1914	16 00.2	136 24	4 16.6E	43 09.3	.35107	FB
Borroloola	Jun. 13, 1914	16 04.2	136 22	4 17.1E	..	.35066	FB
	Jun. 14, 1914	..	..	..	43 17.1	..	FB
Ryan's Bend . . .	Jun. 15, 1914	16 08.2	136 08	4 13.0E	43 29.6	.34982	FB
Wild Dog Spring .	Sep. 15, 1914	16 14.1	128 21	2 55.0E	44 28.5	.34598	EK
Sunday Island . .	Oct. 4, 1914	16 24.5	123 12	2 05.6E	45 28.7	.34121	WCP
Bow Creek . . .	Sep. 13, 1914	16 39.8	128 12	2 44.1E	45 14.6	.34452	EK
Turkey Creek . .	Sep. 11, 1914	17 01.9	128 13	2 06.2E	45 50.3	.34481	EK
Derby	Sep. 9, 1914	17 17.8	123 38	2 08.5E	..	.33787	WCP
	Sep. 10, 1914	..	..	..	46 43.4	..	WCP
Fourteen-mile Creek	Sep. 7, 1914	17 44.8	127 52	2 45.7E	46 45.4	.33897	EK
Rosie's Creek . .	Sep. 5, 1914	17 47.3	127 48	2 41.7E	46 56.3	.33876	EK
Broome, B . . .	Oct. 12, 1914	17 58.1	122 13	1 56.4E	..	..	WCP
Broome, A . . .	Sep. 7, 1914	17 58.4	122 13	1 49.7E	47 59.0	.33260	WCP
Moola Bulla . . .	Sep. 2, 1914	18 11.8	127 28	2 31.2E	47 42.4	.33598	EK
Hall's Creek . . .	Aug. 25, 1914	18 15.3	127 46	2 24.1E	47 37.9	.33546	EK
Flora Valley . . .	Aug. 18, 1914	18 16.0	127 59	2 31.2E	48 01.7	.33580	EK
Cow Creek	Aug. 14, 1914	18 38.5	128 22	..	48 15.3	..	EK
	Aug. 15, 1914	..	..	2 52.3E	..	.33428	EK
Sturt Creek . . .	Aug. 12, 1914	19 08.2	128 13	2 47.3E	48 45.8	.33220	EK
Wolf Creek . . .	Aug. 10, 1914	19 22.3	127 48	2 35.4E	49 12.1	.33047	EK
Cutharra Pool . .	Aug. 7, 1914	19 43.5	127 34	2 33.6E	49 49.7	.32730	EK
Lungan Pool . . .	Aug. 5, 1914	20 01.4	127 26	2 34.7E	50 12.7	.32614	EK
Well No. 50 . . .	Aug. 3, 1914	20 12.8	127 01	2 36.6E	50 31.5	.32457	EK
Well No. 48 . . .	Jul. 31, 1914	20 15.2	126 35	2 13.6E	50 51.7	.32106	EK
Port Hedland . .	Aug. 31, 1914	20 18.7	118 35	0 22.6E	51 40.8	.31742	WCP
Kuduarra	Jul. 29, 1914	20 38.4	126 20	2 16.8E	51 07.1	.32280	EK
Ballaballa . . .	Sep. 3, 1914	20 41.4	117 49	0 17.8E	52 21.0	.31346	WCP
Pijallinga Claypan	Jul. 27, 1914	20 54.5	126 10	2 11.8E	51 26.5	.32127	EK
Marble Bar . . .	Aug. 27, 1914	21 11.4	119 44	1 33.4E	52 40.5	.31482	WCP
Billowaggi . . .	Jul. 24, 1914	21 13.8	125 59	..	51 52.0	..	EK
	Jul. 25, 1914	..	..	2 03.8E	..	.32000	EK
Guli	Jul. 23, 1914	21 19.5	125 53	..	52 05.7	..	EK
	Jul. 24, 1914	..	..	2 02.7E	..	.31938	EK
Wadawalla	Jul. 21, 1914	21 40.3	125 47	1 58.8E	52 31.9	.31702	EK
Nullagine	Aug. 20, 1914	21 53.0	120 07	0 49.2E	53 34.8	.30823	WCP
Wardabunna . . .	Jul. 19, 1914	21 57.8	125 31	1 53.7E	52 53.3	.31538	EK
Wanda	Jul. 16, 1914	22 08.4	125 15	..	53 09.0	..	EK
	Jul. 17, 1914	..	..	1 51.9E	..	.31436	EK
Spinifex Camp . .	Jul. 14, 1914	22 18.2	124 47	1 55.5E	53 24.4	.31320	EK
Well No. 31 . . .	Jul. 11, 1914	22 31.7	124 21	..	53 57.9	..	EK
	Jul. 12, 1914	..	..	1 32.4E	..	.31088	EK
Well No. 29 . . .	Jul. 9, 1914	22 33.4	123 48	1 27.6E	53 51.3	.31124	EK
Well No. 27 . . .	Jul. 7, 1914	22 47.8	123 34	..	54 17.6	..	EK
	Jul. 8, 1914	..	..	0 55.2E	..	.31014	EK
Ethel Creek . . .	Aug. 17, 1914	22 54.5	120 10	0 23.2E	55 10.5	.30168	WCP
Karara Soaks . .	Jul. 5, 1914	23 06.8	123 18	0 52.3E	55 10.6	.30365	EK
Well No. 21 . . .	Jul. 2, 1914	23 10.8	122 44	1 09.7E	54 47.1	.30535	EK
Rockhampton . .	Mar. 25, 1914	23 22.0	150 30	8 03.4E	51 12.2	.32525	FB
Well No. 19 . . .	Jun. 30, 1914	23 25.2	122 28	..	55 12.3	..	EK
	Jul. 1, 1914	..	..	1 10.4E	..	.30313	EK
Water No. 17 . .	Jun. 28, 1914	23 43.5	122 27	0 50.0F	55 34.5	.30160	EK

Station.	Date.	Lat. S.	Long. E.	Declination	Dip. S.	Horizontal Intensity.	Obs'r.
						C.G.S	
Mundawindi . . .	Aug. 16, 1914	23 53.4	120 10	0 07.6E	56 10.2	.29651	WCP
Well No. 15 . . .	Jun. 25, 1914	24 08.4	122 10	..	56 09.3	..	EK
	Jun. 26, 1914	..	..	0 51.5E	..	.30006	EK
Well No. 13 . . .	Jun. 23, 1914	24 25.5	121 57	..	56 48.5	..	EK
	Jun. 24, 1914	..	..	0 39.6E	..	.29585	EK
Goodwin Soak . .	Jun. 21, 1914	24 44.6	121 43	0 33.6E	57 13.6	.29092	EK
Bald Hill	Aug. 14, 1914	24 49.5	119 36	0 20.8W	57 05.5	.29617	WCP
Carnarvon	Dec. 13, 1914	24 53.2	113 39	2 22.1W	58 01.8	.28275	FB
Weld Spring . . .	Jun. 18, 1914	25 01.2	121 33	0 43.2E	57 05.9	.29511	EK
Well No. 7 . . .	Jun. 16, 1914	25 09.7	121 17	0 11.4E	57 09.7	.29439	EK
Well No. 5 . . .	Jun. 14, 1914	25 22.8	121 01	..	51 46.2	..	EK
	Jun. 15, 1914	..	..	0 22.1W	..	.28916	EK
Well No. 4 . . .	Jun. 11, 1914	25 37.2	120 33	0 21.0E	57 24.3	.29335	EK
Peak Hill	Aug. 12, 1914	25 37.6	118 44	..	58 02.1	..	WCP
	Aug. 13, 1914	..	..	0 10.8W	..	.28600	WCP
Birdsville	Jun. 9, 1914	25 54.3	139 21	5 20.4E	..	.30286	ALK
	Jun. 10, 1914	..	..	..	56 09.5	..	ALK
Water No. 2A . .	Jun. 8, 1914	26 00.9	120 20	0 29.8W	58 40.5	.28489	EK
Miranda	Jun. 6, 1914	26 03.9	139 52	5 28.0E	56 20.7	.30206	ALK
Cadelga	Jun. 3, 1914	26 05.5	140 24	5 37.4E	56 20.7	.30148	ALK
Cart Hole Waterhole	Jun. 12, 1914	26 20.9	139 15	5 17.2E	56 49.7	.29962	ALK
Haddon Downs .	May 31, 1914	26 21.0	140 50	5 42.4E	56 32.8	.30092	ALK
Kookabubba Well .	Jun. 6, 1914	26 21.2	120 18	0 34.4W	58 54.3	.28312	EK
Wiluna	Jun. 3, 1914	26 34.7	120 14	0 25.6W	59 01.0	.28187	EK
Meekatharra . . .	Aug. 11, 1914	26 35.2	118 30	1 06.8W	59 02.4	.28058	WCP
Cordillo Downs .	May 27, 1914	26 42.9	140 38	5 42.5E	..	.29844	ALK
	May 28, 1914	..	..	..	57 02.3	..	ALK
Abercromby Well .	May 31, 1914	26 51.6	120 20	0 32.7W	59 31.1	.28008	EK
Moorilyanna . . .	Sep. 25, 1914	26 52.2	133 01	3 19.6E	..	.29121	GFD
	Oct. 1, 1914	..	..	..	58 22.4	..	GFD
Moorilyanna, Secondary . . .	Oct. 1, 1914	26 52.5	133 01	3 44.2E	..	.28678	GFD
	Oct. 2, 1914	..	..	..	58 51.0	..	GFD
Goyder's Lagoon .	Jun. 15, 1914	26 56.7	138 57	5 14.4E	..	.29598	ALK
	Jun. 16, 1914	..	..	..	57 27.1	..	ALK
Wantapella . . .	Sep. 17, 1914	27 00.9	133 28	3 31.4E	..	.29184	GFD
	Oct. 10, 1914	..	..	..	58 14.5	..	GFD
Todmorden . . .	Sep. 7, 1914	27 08.5	134 45	4 01.1E	..	.29243	GFD
	Sep. 8, 1914	..	..	..	58 09.4	..	GFD
Logan Well . . .	May 29, 1914	27 15.7	120 28	..	59 52.3	..	EK
	May 30, 1914	..	..	0 33.8W	..	.27759	EK
Musgrave Range .	Sep. 10, to	27 16	134 01	3 41 E	(Mean of 20		
	Nov. 1, 1914.	determinations with compass.)				..	GFD
Mount Gason Bore	Jun. 18, 1914	27 20.2	138 45	5 15.8E	..	.29342	ALK
	Jun. 19, 1914	..	..	..	57 58.0	..	ALK
Patchawarra Well, 1	May 16, 1914	27 20.9	140 41	5 51.4E	..	.29386	ALK
Patchawarra Well, 2	May 20, 1914	27 20.9	140 41	5 52.6E	..	.29366	ALK
	May 21, 1914	..	..	..	57 50.5	..	ALK
Cue	Aug. 8, 1914	27 25.6	117 53	1 38.2W	60 22.9	.27257	WCP
Brisbane	Mar. 23, 1914	27 27.0	153 02	9 04.3E	56 07.9	.30146	FB
Marble Well . . .	Oct. 16, 1914	27 33.1	134 00	4 23.6E	..	..	GFD
Stanley's Well . .	Oct. 22, 1914	27 42.6	134 07	..	58 44.5	..	GFD
	Oct. 23, 1914	..	..	3 28.8E	..	.28870	GFD
Lake Miranda . .	May 27, 1914	27 43.2	120 33	0 52.0W	60 03.5	.27799	EK
Mirra-mitta Bore .	Jun. 21, 1914	27 43.7	138 44	5 06.0E	58 26.0	.29048	ALK
Innamincka, 1 . .	May 5, 1914	27 45.5	140 44	5 53.3E	58 16.6	.29180	ALK
	May 6, 1914	..	..	..	58 13.5	..	ALK
Innamincka, 2 . .	May 12, 1914	27 45.7	140 44	5 53.8E	..	.29194	ALK
Christlieb Well . .	Oct. 27, 1914	27 57.2	134 46	4 17.4E	..	.28700	GFD
Lawlers	May 25, 1914	28 05.2	120.30	0 19.8W	61 08.8	.27185	EK
Raspberry Creek Bore	Oct. 30, 1914	28 08.2	135 05	3 43.6E	59 26.0	.28546	GFD
Nappacoongie Well	May 2, 1914	28 11.8	140 30	5 48.4E	58 47.0	.28920	ALK
Nilpinna	Nov. 3, 1914	28 13.1	135 42	4 07.4E	..	.28391	GFD
	Nov. 4, 1914	..	..	..	59 47.6	..	GFD
Ooroowilanie Reservoir . . .	Jun. 24, 1914	28 17.0	138 40	5 08.5E	59 03.6	.28748	ALK
Bunbenoo, A . .	Oct. 14, 1916	28 17.0	115 54	2 38.7W	62 02.1	.26202	W&P

Station.	Date.	Lat. S.	Long. E.	Declination	Dip. S.	Horizontal Intensity.	Obs'r.
		° ′	° ′	° ′	° ′	C.G.S	
Bunbenoo, A . . .	Oct. 16, 1916	..	..	..	62 01.2	..	W&P
Bunbenoo, B . .	Oct. 16, 1916	28 17.1	115 54	2 55.9W	61 51.0	..	W&P
Bunbenoo, C . .	Oct. 16, 1916	28 17.1	115 54	2 41.4W	61 50.4	..	W&P
Tallering, A . . .	Oct. 11, 1916	28 19.9	115 49	2 41.8W	62 01.6	.26258	W&P
Tallering, B . . .	Oct. 12, 1916	28 20.0	115 49	2 59.9W	61 50.0	.26342	W&P
Tallering, C . . .	Oct. 13, 1916	28 20.0	115 49	2 34.3W	61 42.8	.26378	W&P
Warren's Flat, A .	Oct. 17, 1916	28 20.0	115 47	2 27.2W	61 50.1	.26432	W&P
	Oct. 18, 1916	..	..	..	61 50.9	..	W&P
Warren's Flat, B .	Oct. 18, 1916	28 20.1	115 47	2 36.7W	61 53.9	..	W&P
Warren's Flat, C .	Oct. 18, 1916	28 20.1	115 47	2 32.5W	61 58.2	..	W&P
Tallering (Sand-plain), A . . .	Oct. 19, 1916	28 21.1	115 48	2 36.9W	61 46.4	.26538	W&P
	Oct. 20, 1916	..	..	..	61 45.4	..	W&P
Tallering (Sand-plain), B . . .	Oct. 20, 1916	28 21.2	115 48	2 23.4W	62 08.1	..	W&P
Tallering (Sand-plain), C . . .	Oct. 20, 1916	28 21.2	115 48	2 06.4W	61 43.5	..	W&P
Woondenooka, A .	Oct. 23, 1916	28 24.5	115 29	3 49.3W	61 43.8	.26459	W&P
Woondenooka, B .	Oct. 23, 1916	28 24.6	115 29	3 45.5W	61 48.2	..	W&P
Woondenooka, C .	Oct. 23, 1916	28 24.6	115 29	3 44.2W	61 48.2	..	W&P
Pindar, B	Sep. 15, 1916	28 28.2	115 45	3 07.4W	61 50.1	.26408	W&P
Pindar, D	Sep. 18, 1916	28 28.2	115 45	3 12.8W	61 51.2	.26452	W&P
	Sep. 18, 1916	..	..	3 09.8W	..	..	W&P
Pindar, A	Sep. 14, 1916	28 28.3	115 45	3 07.4	61 49.8	.26442	W&P
Pindar, C	Sep. 16, 1916	28 28.3	115 45	3 10.0W	61 50.9	.26450	W&P
Pindar, E	Sep. 19, 1916	28 29.6	115 48	3 04.0W	61 54.6	.26272	W&P
Pindar, G	Sep. 21, 1916	28 29.6	115 48	2 34.7W	62 01.8	.26232	W&P
Pindar, F	Sep. 20, 1916	28 29.7	115 48	2 56.5W	61 56.2	.26242	W&P
Mullewa, A . . .	Oct. 24, 1916	28 32.0	115 30	3 29.5W	62 00.5	..	W&P
Mullewa, B . . .	Oct. 24, 1916	28 32.1	115 30	3 26.9W	61 59.4	..	W&P
Mullewa, C . . .	Oct. 24, 1916	28 32.1	115 30	3 31.2W	62 04.8	..	W&P
Murta Murta Well	Apr. 29, 1914	28 36.7	140 17	5 42.8E	..	.28667	ALK
	Apr. 30, 1914	..	..	..	59 15.2	..	ALK
Etadunna	Jun. 27, 1914	28 43.1	138 38	5 23.2E	59 28.9	.28484	ALK
Leonora	May 20, 1914	28 52.0	121 18	0 30.0W	61 32.9	.26811	EK
Dromedary Hill .	Aug. 6, 1914	29 02.1	118 27	1 40.9W	62 11.2	.25961	WCP
Carraweena . . .	Apr. 26, 1914	29 11.0	139 59	5 43.2E	..	.28336	ALK
	Apr. 27, 1914	..	..	..	59 57.8	..	ALK
Clayton Bore . . .	Jun. 30, 1914	29 16.8	138 23	5 16.8E	60 02.7	.28282	ALK
Murnpeowie . . .	Apr. 19, 1914	29 35.3	139 03	5 31.3E	60 20.2	.28048	ALK
Mount Hopeless Bore	Apr. 23, 1914	29 36.4	139 45	5 26.2E	..	.28050	ALK
	Apr. 24, 1914	..	..	..	60 17.7	..	ALK
Hergott Springs .	Jul. 5, 1914	29 39.4	138 03	5 11.5E	60 33.2	.27934	ALK
Pinjarrega, B . .	Nov. 15, 1916	30 02.5	115 57	4 09.5W	63 21.8	.25356	W&P
Pinjarrega, C . .	Nov. 17, 1916	30 02.5	115 57	4 03.2W	63 20.9	.25321	W&P
Farina, A	Apr. 9, 1914	30 04.4	138 17	5 52.0E	61 01.4	.27632	ALK
	Apr. 10, 1914	..	..	..	61 01.5	..	ALK
Marchagee, A . .	Nov. 9, 1916	30 05.1	115 56	4 20.8W	63 24.8	.25317	W&P
	Nov. 10, 1916	..	..	..	63 23.0		W&P
Marchagee, D . .	Nov. 10, 1916	30 05.1	115 56	4 16.2W	63 26.8		W&P
	Nov. 11, 1916	..	..	..	..	.25326	W&P
Marchagee, B . .	Nov. 10, 1916	30 05.2	115 56	4 16.0W	63 23.4	..	W&P
	Nov. 11, 1916	..	..	..	..	.25330	W&P
Marchagee, C . .	Nov. 10, 1916	30 05.2	115 56	4 17.8W	63 25.8	..	W&P
	Nov. 11, 1916	..	..	..	..	.25334	W&P
Mount Lyndhurst .	Apr. 15, 1914	30 11.0	138 42	5 32.9E	61 02.2	.27534	ALK
Watheroo, A . . .	Dec. 20, 1916	30 17.8	116 03	4 10.1W	64 01.3	.25100	W&P
Watheroo, Observatory Site, B . .	Feb. 10, 1917	30 18.9	115 53	4 23.8W	63 43.2	.25052	W&P
Watheroo, Observatory Site, C .	Feb. 12, 1917	30 19.0	115 53	4 21.7W	63 42.2	.25082	W&P
Watheroo, Observatory Site, D .	Feb. 13, 1917	30 19.0	115 53	4 25.7W	63 42.0	.25074	W&P
Managum Well, A	Feb. 5, 1917	30 20.6	115 58	4 57.7W	63 49.7	.24998	W&P
	Feb. 9, 1917	..	..	..	63 53.8	..	W&P
Managum Well, B	Feb. 9, 1917	30 20.6	115 58	4 51.2W	63 52.2	..	W&P
Managum Well, C	Feb. 9, 1917	30 20.6	115 58	5 06.3W	63 52.5	..	W&P
Rabbit-proof Fence No. 3	Aug. 4, 1914	30 23.4	118 32	2 34.6W	63 21.4	.25528	WCP

Station.	Date.	Lat. S.	Long. E.	Declination.	Dip. S.	Horizontal Intensity. C.G.S	Obs'r.
Carnding Well . .	Sep. 12, 1914	30 27.4	134 13	4 07.6E	..	.26680	ALK
	Sep. 13, 1914	..	..	..	62 10.8	..	ALK
Ooldea Bore . . .	Sep. 23, 1914	30 27.9	131 50	3 07.2E	..	.26782	ALK
	Sep. 24, 1914	..	..	..	62 16.6	..	ALK
Yallalie Well . . .	Jan. 27, 1917	30 28.2	115 47	4 11.8W	68 53.8	.24928	W&P
Bore A	Sep. 25, 1914	30 30.2	131 25	2 56.0E	62 04.9	.26874	ALK
Green's Well . . .	Jan. 25, 1917	30 31.5	115 44	4 06.5W	68 55.0	.24886	W&P
Bench Mark, 56½	Sep. 19, 1914	30 32.8	132 46	3 00.4E	61 44.6	.27210	ALK
Wynbring Rock Hole	Sep. 16, 1914	30 33.7	133 39	3 45.8E	63 04.7	.26448	ALK
Bore B	Sep. 26, 1914	30 34.1	130 55	2 27.0E	62 11.8	.26850	ALK
Karamara, 4N . .	Jul. 14, 1916	30 37.9	115 52	..	63 57.7	..	P&R
Karamara, 6N . .	Jul. 14, 1916	30 37.9	115 52	..	63 58.6	..	P&R
Moora	Jul. 22, 1914	30 38.0	115 59	4 40.9W	63 52.8	.25016	WCP
Karamara, A . .	Jul. 14, 1916	30 38.0	115 52	..	..	.24875	P&R
Karamara, 2N . .	Jul. 14, 1916	30 38.0	115 52	..	63 58.9	..	P&R
Karamara, 2S . .	Jul. 14, 1916	30 38.0	115 52	..	63 57.7	..	P&R
Karamara, 4S . .	Jul. 14, 1916	30 38.1	115 52	..	63 59.7	..	P&R
Karamara, 6S . .	Jul. 14, 1916	30 38.1	115 52	..	63 58.5	..	P&R
Tarcoola	Sep. 8, 1914	30 41.8	134 34	4 04.8E	62 09.4	.26544	ALK
Gilbert's Well . .	Sep. 5, 1914	30 51.4	135 06	..	62 08.8	..	ALK
	Sep. 6, 1914	..	..	3 36.2E	62 09.5	.26796	ALK
Wongan Hills, A .	Jul. 29, 1916	30 53.6	116 43	3 40.0W	64 12.8	.24908	WCP
	Sep. 9, 1916	..	..	3 37.8W	64 14.4	.24881	W&P
Wongan Hills, A, Secondary . . .	Jul. 29, 1916	30 53.6	116 43	3 35.7W	..	..	WCP
Wongan Hills, B .	Sep. 10, 1916	30 53.6	116 43	1 50.1W	64 07.0	.24897	W&P
Wongan Hills, C .	Sep. 11, 1916	30 53.6	116 43	3 36.6W	64 06.4	.24990	W&P
	Sep. 11, 1916	..	..	3 31.9W	..	..	W&P
Coolgardie	May 9, 1914	30 57.2	121 11	1 33.6W	63 32.5	.25522	EK
McArthur's Well .	Sep. 3, 1914	31 01.4	135 43	4 15.5E	62 30.9	.26782	ALK
Nealyon's Rockhole	Oct. 1, 1914	31 07.0	131 17	3 15.0E	62 50.0	.26358	ALK
Wirraminna . . .	Sep. 1, 1914	31 10.9	136 16	4 20.7E	62 40.6	.26560	ALK
East-West Railway Siding	Aug. 27, 1914	31 16	136 47	4 28.1E	..	.26729	ALK
	Aug. 28, 1914	..	..	4 27.6E	62 31.2	.26716	ALK
Burracoppin, D .	Aug. 31, 1916	31 21.0	118 33	2 05.2W	64 25.1	.24850	WCP
Burracoppin, B .	Aug. 29, 1916	31 21.1	118 33	2 21.0W	64 49.3	.24483	W&P
Burracoppin, C .	Aug. 30, 1916	31 21.2	118 33	2 36.4W	64 48.2	.24447	W&P
Burracoppin, A .	Aug. 26, 1916	31 24.4	118 31	2 00.2W	64 24.7	.24876	W&P
Mallabie Tanks . .	Oct. 4, 1914	31 27.8	130 39	2 04.2E	..	.25917	ALK
	Oct. 5, 1914	..	..	..	63 38.1	..	ALK
Yangoonabie . . .	Oct. 6, 1914	31 28.5	130 05	2 02.8E	63 46.8	.25826	ALK
Merredin, A . . .	Sep. 2, 1916	31 28.6	118 17	3 28.2W	64 32.6	.24810	W&P
Merredin, B . . .	Sep. 4, 1916	31 28.6	118 17	3 05.4W	64 58.0	.24448	W&P
Bunabie	Oct. 8, 1914	31 31.2	129 22	1 48.7E	..	.26018	ALK
	Oct. 9, 1914	..	..	..	63 17.7	..	ALK
Rabbit-proof Fence 2	Aug. 2, 1914	31 39.0	118 42	2 56.2W	64 58.5	.24640	WCP
Eucla	Jun. 12, 1914	31 43.3	128 53	1 43.7E	63 37.6	.25832	WCP
	Jun. 14, 1914	..	..	1 41.4E	..	.25840	WCP
	Jun. 14, 1914	..	..	1 39.6E	..	..	WCP
	Oct. 31, 1914	..	..	1 48.6E	63 35.2	.25836	ALK
Madura	Jun. 17, 1914	31 54.2	127 02	2 01.0E	64 00.6	.25410	WCP
Bookooloo	Aug 23, 1914	31 54.2	137 22	4 45.8E	63 18.4	.26101	ALK
Perth	Apr. 6, 1914	31 58.0	115 50	4 43.0W	65 06.8	..	WCP
	Apr. 8, 1914	..	..	..	..	.24244	WCP
	Apr. 13, 1914	..	..	4 41.6W	65 03.1	.24239	EK
	Jun. 13, 1916	..	..	4 41.8W	..	.24152	WCP
	Jun. 15, 1916	..	..	4 45.1W	..	..	WCP
Cottesloe, A . . .	Nov. 18, to Nov. 25, 1914	31 59.0	115 45	4 43.8W	..	.24280	EK
	Nov. 26, to Dec. 5, 1914	..	..	..	65 03.6	..	K&B
	Jun. 30, 1916	..	..	4 44.0W	..	.24138	WCP
	July 1, 1916	..	..	4 42.2W	..	..	WCP
	July 6, 1916	..	..	..	65 11.1	..	WCP
	Aug. 16, 1916	..	..	4 45.6W	..	..	WCP
	Oct. 2, 1916	..	..	4 48.4W	..	..	WCP
	Nov. 16, 1916	..	..	4 46.5W	..	..	WCP

Station.	Date.	Lat. S.	Long. E.	Declina-tion.	Dip. S.	Hori-zontal Inten-sity. C.G.S	Obs'r.
Cottesloe, B . . .	Nov. 18, to Nov. 25, 1914	31 59.0	115 45	4 42.6W	..	.24226	WCP
	Nov. 26, to Dec. 5, 1914	..	..	..	65 03.4	..	WCP
Cottesloe, C . . .	Nov. 18, to Nov. 25, 1914	31 59.0	115 45	4 42.6W	..	.24227	B&K
Rottnest Island .	Apr. 14, 1914	32 00.2	115 33	4 47.6W	65 27.3	.24164	WCP
Norseman	Jun. 25, 1914	32 12.2	121 48	4 34.6W	64 47.7	.24692	WCP
Cardanumbi . . .	Jun. 8, 1914	32 16.3	125 38	0 12.5E	64 36.2	.25040	WCP
Balladonia	Jun. 6, 1914	32 28.4	123 53	0 22.7W	65 08.6	.24533	WCP
	Jun. 20, 1914	..	..	..	65 04.2	..	WCP
Port Augusta . .	Aug. 6, 1914	32 29.7	137 46	4 48.7E	..	.25607	ALK
	Aug. 7, 1914	..	..	4 53.7E	64 07.0	.25605	ALK
Wilmington . . .	Sep. 2, 1916	32 39.3	138 05	..	64 08.6	..	GFD
	Sep. 5, 1916	..	..	5 43.8E	..	.25614	GFD
Melrose	Sep. 12, 1916	32 48.4	138 12	..	64 03.2	..	GFD
	Sep. 13, 1916	..	..	5 47.0E	..	.25618	GFD
Booleroo Centre .	Sep. 20, 1916	32 53.0	138 21	..	63 58.4	..	GFD
	Sep. 21, 1916	..	..	5 40.8E	..	.25686	GFD
	Sep. 23, 1916	..	..	5 41.5E	..	.25637	GFD
Rabbit-proof Fence, 1 . . .	May 21, 1914	32 54.0	119 48	..	65 48.4	..	WCP
	May 22, 1914	..	..	2 25.4W	..	.23978	WCP
Bunbury	Apr. 25, 1914	33 19.5	115 38	5 41.8W	66 11.5	.23404	WCP
Israelite Bay . .	May 30, 1914	33 36.4	123 48	..	66 00.8	.24066	WCP
Red Hill, A . . .	May 26, 1916	33 44.5	151 04	..	63 17.8	..	WCP
	May 27, 1916	..	..	9 13.8E	..	.26117	WCP
Red Hill, B . . .	Jan. 12, 1915	33 44.5	151 04	9 19.2E	63 15.7	.26170	WCP
Esperance	May 27, 1914	33 51.4	121 53	2 23.2W	66 34.6	.23371	WCP
Hopetoun	May 19, 1914	33 53.6	120 09	3 22.1W	66 25.0	.23554	WCP
Eleven-mile Dam, A	July 23, 1916	34 16.8	117 45	..	67 13.4	..	WCP
Eleven-mile Dam, B	July 23, 1916	34 16.8	117 45	..	67 19.0	..	WCP
Kapunda	Dec. 23, 1915	34 20.4	138 55	6 30.2E	65 11.4	.24810	GFD
Cape Leeuwin . .	Apr. 28, 1914	34 22.1	115 08	5 50.8W	67 37.1	.22404	WCP
Marra	May 16, 1914	34 25.4	118 47	6 24.8W	68 47.3	.21899	WCP
Angaston	Dec. 21, 1915	34 30.5	139 03	6 43.6E	65 43.0	.24394	GFD
Roseworthy . . .	Sep. 6, 1915	34 32.0	138 45	6 11.8E	..	.24592	GFD
	Sep. 7, 1915	..	..	..	65 40.2	..	GFD
Gawler	Dec. 16, 1915	34 37.1	138 44	..	65 52.6	..	GFD
	Dec. 17, 1915	..	..	6 00.6E	..	.24454	GFD
Adelaide (South Park)	Mar. 6, 1914	34 56.2	138 36	5 48.4E	66 08.2	.24273	FB
Port Frankland .	May 5, 1914	34 59.8	116 49	5 56.3W	67 37.8	.22476	WCP
Blackwood, A . .	Mar. 11, to Mar. 14, 1914	35 00.6	138 36	5 17.1E	66 08.2	.24203	WCP
Blackwood, B . .	Mar. 11, to Mar. 14, 1914	35 00.6	138 36	5 18.3E	..	.24202	EK
Blackwood, C . .	Mar. 11, to Mar. 14, 1914	35 00.6	138 36	5 19.0E	..	.24204	FB
Albany	May 9, 1914	35 01.3	117 55	5 18.3W	67 20.7	.22822	WCP
	Jun. 18, 1916	..	..	5 12.2W	67 26.9	.22770	WCP
Nairne	Jan. 9, 1918	35 02.4	138 54	6 10.5E	..	.24050	D&G
	Jan. 10, 1918	..	..	6 06.6E	66 03.3	..	D&G
Murray Bridge . .	Mar. 20, 1914	35 07.2	139 16	5 31.8E	66 18.2	.24051	KPK
Goolwa	Jan. 16, 1918	35 30.0	138 47	..	66 33.3	..	G&D
	Jan. 17, 1918	..	..	5 28.5E	..	.23781	D&G
	Jan. 18, 1918	..	..	..	66 38.8	..	D&G
Port Victor . . .	Mar. 17, 1914	35 31.8	138 37	..	66 39.4	..	P&K
	Mar. 18, 1914	..	..	5 43.6E	66 39.2	.23690	P&K
Port Victor, Secondary . . .	Mar. 18, 1914	35 31.8	138 37	..	66 39.8	..	EK
Border Town . .	Mar. 21, 1914	36 18.5	140 46	6 22.4E	67 04.2	.23600	P&K
	May 26, 1916	..	..	..	67 07.7	..	GFD
	May 27, 1916	..	..	6 14.0E	..	.23520	GFD
Kingston	Mar. 6, 1917	36 49.8	139 51	5 49.2E	67 51.8	.23182	D&G
Kybybolite	May 16, 1917	36 53.2	140 55	..	67 43.8	..	D&G
	May 19, 1917	..	..	5 55.1E	..	.22864	D&G
Naracoorte	May 29, 1916	36 57.0	140 45	6 25.9E	..	.23124	G&B
	May 30, 1916	..	..	6 21.8E	..	..	G&B
Robe	Feb. 26, 1917	37 09.8	139 45	5 31.9E	..	.22771	D&G

Station.	Date.	Lat. S.	Long. E.	Declination.	Dip. S.	Horizontal Intensity. C.G.S	Obs'r.
Robe	Feb. 27, 1917	..	..	..	67 58.7	..	D&G
Long Gully	Feb. 28, 1917	37 18.2	139 50	5 36.0E	68 09.8	.22746	D&G
Penola	Dec. 20, 1916	37 22.6	140 50	6 32.6E	..	.22838	D&G
	Dec. 21, 1916	..	..	..	67 58.0	..	D&G
Beachport	Mar. 23, 1914	37 28.8	140 00	5 33.1E	..	.22530	P&K
	Mar. 24, 1914	..	..	..	68 25.8	..	P&K
Beachport, Secondary	Mar. 23, 1914	37 28.8	140 00	..	68 25.4	..	EK
	Mar. 24, 1914	..	..	5 27.3E	..	..	EK
Mount Ruskin	Feb. 25, 1918	38 03.0	140 58	..	68 35.2	..	D&G
	Feb. 26, 1918	..	..	6 19.0E	..	.22254	D&G
Port MacDonnell	Feb. 12, 1918	38 03.4	140 42	6 06.0E	..	.22260	D&G
	Feb. 14, 1918	..	..	..	68 37.8	..	D&G
Currie, B	Jan. 20, 1914	39 54.3	143 51	8 02.5E	69 37.2	.21543	EK
Currie, A	Jan. 18, 1914	39 56.0	143 50	..	69 39.6	..	EK
	Jan. 19, 1914	..	..	8 09.1E	..	.21513	EK
Currie, A, Secondary	Jan. 19, 1914	39 56.0	143 50	8 19 E	..	..	EK
White Mark	Jan. 22, 1914	40 07.4	148 02	9 36.5E	69 18.3	.21786	FB
	Jan. 23, 1914	..	..	9 30.0E	..	..	FB
	Jan. 23, 1914	..	..	9 35.4E	..	..	FB
White Mark, Secondary	Jan. 23, 1914	40 07.4	148 02	9 31.2E	..	..	FB
Gladstone	Jan. 14, 1914	40 57.6	148 00	9 44.1E	69 59.8	.21180	FB
	Jan. 14, 1914	..	..	9 50.9E	..	..	FB
Latrobe	Jan. 14, 1914	41 14.8	146 27	9 36.9E	..	..20928	EK
	Jan. 15, 1914	..	..	..	70 25.2	..	EK
Scamander, A	Jan. 12, 1914	41 26.7	148 18	9 55.6E	70 21.6	.20929	EK
Scamander, B	Jan. 12, 1914	41 26.7	148 18	9 49.8E	..	..	EK
Strahan	Jan. 18, 1914	42 09.6	145 21	9 01.8E	71 17.7	.20188	FB
Oatlands	Jan. 9, 1914	42 17.2	147 23	9 17.7E	71 00.8	.20268	K&B
Hobart, D	Jan. 7, 1914	42 52.2	147 21	9 01.6E	71 23.4	.19932	K&B
	Jan. 7, 1914	..	..	9 02.4E	..	..	K&B
Hobart, D, Secondary	Jan. 7, 1914	42 52.2	147 21	9 06.8E	..	..	EK
Southport, A	Jan. 2, 1914	43 25.9	147 01	10 56.6E	..	.19008	EK
	Jan. 3, 1914	..	..	..	72 24.2	..	EK
Southport, B	Jan. 3, 1914	43 25.9	147 01	10 21.8E	72 15	..	EK
Southport, C	Jan. 4, 1914	43 26.2	147 00	10 04.9E	72 12.5	.19401	EK

Note: A number of stations were occupied in South Australia by Mr. G. F. Dodwell (GFD), Government Astronomer, with a magnetometer loaned by the Department of Terrestrial Magnetism. These observations have been included in the above. Mr. Dodwell was assisted during one period by Prof. Kerr Grant, of the Adelaide University (D&G).

SKELETONS OF THE MONOTREMES IN THE COLLECTIONS OF THE ARMY MEDICAL MUSEUM AT WASHINGTON.

By Dr. R. W. SHUFELDT, C.M.Z.S., Washington, D.C.

Plates XVIII.-XXII.

[Originally written for the Hobart-Melbourne meeting of the Australasian Association for the Advancement of Science, January, 1921]*

(Read before the Royal Society of Tasmania, 8th August, 1921.)

Attention was recently invited to the existence in the collections of the Army Medical Museum, of the Surgeon General's Office, at Washington, of the mounted skeletons of certain of the *Monotremata;* and as these curious mammals are now becoming extremely rare, a brief account of the specimens of them will probably prove of value to the comparative anatomists of the future, and of more or less interest to those of the present time. (1)

These skeletons consist of one of an Echidna, and two of the Duckbill *Platypus* or *Ornithorhynchus.* On the Echidna skeleton the label reads:—"2496 Comp. Anat. Ser.—Spiny "ant-eater; echidna aculeata or hystrix. From New South "Wales. The jaws are without teeth; roof of mouth and "tongue covered with horny spines." This is apparently an adult specimen, prepared and mounted by the Wards of Rochester, and in perfect condition. One of their labels is pasted on the under side of the stand and bears the number 3760 and the statement that the animal was obtained in New South Wales.

The better specimen of the two Duckbills was also prepared by the Wards; it is on a large, solid black-walnut stand without trimmings, and has their unnumbered label

*Owing to the Shipping Strike, the Meeting of the A.A.A.S., which was to have been held in Hobart in January, had to be held in Melbourne. It was found impossible to bring out the usual Report of the A.A.A.S. Meeting and to print all papers. Arrangements were, therefore, made for certain papers to be read before the Society and printed in the Papers and Proceedings for 1921.

(1) SHUFELDT, R. W.—"The Section of Comparative Anatomy of the "Army Medical Museum," *Medical Review of Reviews,* New York, Feb., 1919, Vol. XXV., No. 2, pp. 85-90, 4 figs. Presents a nearly complete list of the vertebrate skeletons in the Section at the time the article appeared.

on the under side, which simply states that it is an "*Ornitho-*"*rhynchus anatinus;* Ornithorhynchus, Australia." This is the larger of the Duckbills, and its Army Medical Museum label reads:—"1304 Comp. Anat. Ser.—Duck bill platypus "from Australia: ornithorhynchus anatinus." Finally we have the smaller skeleton of the *Ornithorhynchus*, in which the skull is broken. It is mounted on a pine board, painted black, and varnished. (Figs. 1 and 2.) It is altogether too long for the specimen, and has an amateurish appearance generally. Its Army Medical Museum label is as follows:—"2639 Comp. Anat. Ser.—Duck-bill male; or ornithorhynchus "paradoxus. From Brazil. The young have functional molar "teeth, but the adult has only transverse horny ridges to "strain the food from the water." (2)

All of these species of monotremes are now being exterminated in nature, especially in those sections of their habitats where man has occupied the country in the greatest numbers. This extermination is, in fact, being effected almost entirely through man's agency, which will fully account for the certainty and more or less rapid increase of the same, and its very probable complete accomplishment in time. As in the case of all other animals, the value of their skeletal remains enhances the nearer their complete extinction is approached; and we may be well assured that, in due time, these three skeletons, should they be preserved, will come to be extremely valuable material.

Not long after the first monotremes fell into the hands of working morphologists, accounts of their anatomy, and particularly their osteology, appeared in numerous places and languages. With the passing of the years, this literature became almost voluminous; while later on the subject was scarcely touched upon.

Pictorially, the bones of the skeleton in both the echidnas and the Duckbill Platypus have been figured a good many times, Sir Richard Owen being one of the heaviest contributors to this side of the subject. When Sir Richard wrote, however, the idea dominated his mind that the vertebrate skull was composed of four metamorphosed vertebræ, and

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(2) Perhaps it will be just as well to note here the errors upon this label, to eliminate any chance of the reader of the article gaining the idea that they were made either by the author or the printer. There is no necessity for the word "or" before "ornithorhynchus," which latter should begin with a capital O. The animal does not come from "Brazil," and the horny ridges on its jaws are placed longitudinally and not "transverse." It is not likely that they are intended to "strain the food from the water," as any one will be convinced of by a casual examination.

R.W.S.

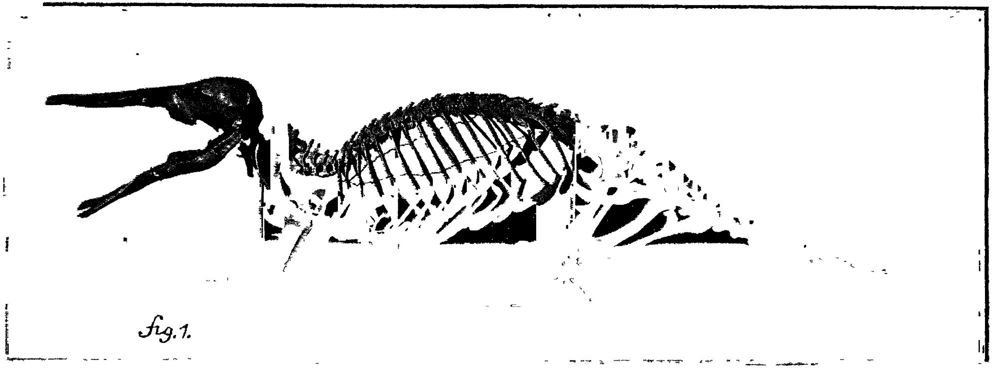

fig. 1.

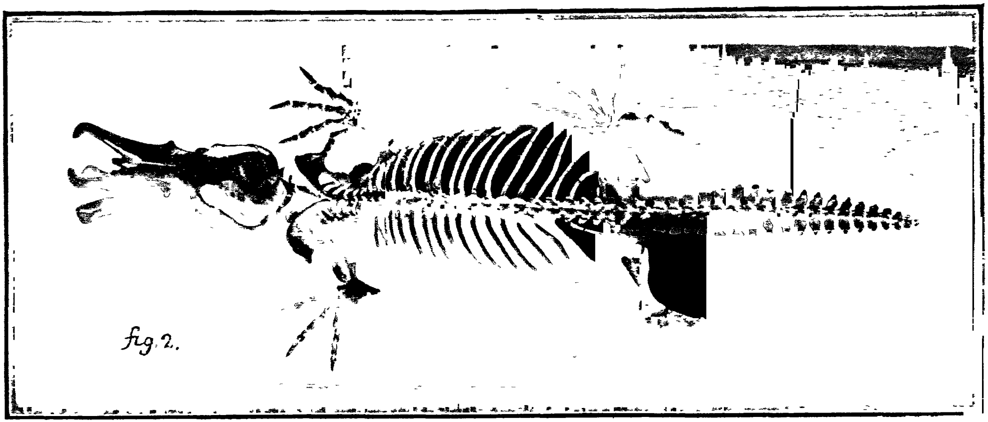

fig. 2.

consequently ornithorhynchine osteology in his hands was duly stamped thereby. Nearly all the illustrations of these curious mammals were prepared by zoological draughtsmen, who, in many instances, knew little or nothing of osteology; the consequence was that this deficiency was reflected, to a greater or less extent, in their work. So far as my knowledge carries me, little or nothing has been done photographically with monotreme osteology; so the illustrations to the present paper should be especially acceptable to mammalian anatomists.

There is one prominent exception to this statement, however, and it is to be found in the admirable memoir by Dr. D. M. S. Watson on "The Monotreme Skull, a Contribu- "tion to Mammalian Morphogenesis." (*Phil. Trans. Ser. B.*, Vol. 207, March, 1916.)

Among the earliest works we have for consultation on the skeletology of this order of mammals, is the famous monograph by Dr. E. d'Alton, with its royal quarto plates and text matter. (3) About seventeen years after the appearance of this work, there was published in the third volume (1841) of *The Encyclopædia of Anatomy and Physiology* (1839-1847), pp. 366-407, Figs. 168-202, the extensive article by Owen on the *Monotremata*, in which he brought all the then known facts about the group up to date. In 1866, in his *Comparative Anatomy and Physiology of Vertebrates* (Vol. II., pp. 312-328), he included the revised account of the osteology of the Monotremes. We meet with various other contributions by the same author; but as they refer to other systems of anatomy of these animals, as well as to special organs and parts, and not to the skeleton, they need not be cited here.

Under the article *Mammalia, Platypus* and *Echidna* in the Ninth Edition of the *Encyclopædia Britannica*, Sir William Henry Flower sums up a large part of our knowledge of these animals (1883); while with respect to their skeletons, we find more detailed accounts in his *Osteology of the Mammalia* (3d. Ed., 1885).

(3) D'ALTON, E., DR.—"Die Skelete der Zahnlosen Thiere," abgebildet und verglichen. Bonn, 1824 (In Commission bei Eduard Weber). Pt. I., No. 8. *Vorrede and Einleitung* occupies 4 pp. of text. *Allgemeine Vergleichungen des Skeletes der Zahnlosen Tiere*, pp. 4-10; p. 11, Description of Plates. Plate I., Skeleton: side view of Ornithorhynchus, nat. size. (Fairly good). II.: Bones of same and an oblique view of the skeleton. Skull to front. Right side shown. III.: Lateral view of skeleton of Echidna. IV.: Skull and other bones of Echidna. 21 figs. Large lithographic plates, and very good for the time. See also the celebrated work of

MECKEL.—*Ornithorhynchi paradoxi Descriptio Anatomica;* Fol. 1826.

Previous to studying these three skeletons of the monotremes in the Army Medical Museum collection—or in connection with their study—the works of Cuvier on the same subject were examined (Leçons d'Anat. Comp. 1837, II., p. 455), as well as the works of Mc. Eydoux and Lament, (4) Geoffrey (Mem. du Museum, tom. XV., p. 32); De Blainville on the Spur and Poison Gland (Bull. Soc. Philomatique, 1817); Blumenbach (Philos. Trans., 1800); Shaw (Naturalists' Miscellany, 1798, Gen. Zool., Vol. I., 1800); Voigt; Home (Philos. Trans., 1802, pp. 67, 356, 1819); Symington and Johnson, who wrote on the homology of the dumb-bell shaped bone in Ornithorhynchus (separate papers under the same title); and the various writings of Carl Gegenbaur. (5)

Of all the general manuals on the osteology of mammals, perhaps no two of them are in more constant use among the researchers of Great Britain, her Colonies, and the United States, than the second volume of Owen's *Comparative Anatomy and Physiology of Vertebrates*, and the last

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(4) Voyage de la Favorite, 1839, tom. V., pl. 9, p. 161.

(5) The following are some of the works that appeared after the third edition of Flower's *Osteology of the Mammalia* in 1885; and through the kindness of Mr. Newton P. Scudder, the Librarian at the United States National Museum, these have all been carefully examined.

RUGE, GEORG, Prof. Dr. (Amsterdam)—"Das Knorpelskelet des aus-"seren Ohres der Monotremen—ein Derivat des Hyoidbogens." Mit 6 Figuren im Text. *Morph. Jahrb.* Leipzig, 1898, pp. 202-223, Figs. 1-6.

This memoir is very complete on the ear-bones.

FRETS, G. P.—"Uber die Entwicklung der Wirbelsaule von Echidna "hystix" (2 Teil), 14 figs. I Teil—Uber die Varietaten der Wirbel saule bei erwachsenen Echidna, 1908, pp. 608-649. This is a very complete work, and on pp. 649-653 an excellent bibliography of the Monotremes is presented.

EMERY, C.—"Ueber Carpus und Tarsus der Monotremen." (Bologna). Pp. 222-223. Verhandlungen des Gesellschaft Deutscher Naturforchen und Arte. Leipzig, 1900.

Van BEMMELEN, J. F. (Communicated by Prof. C. K. Hoffman).—"Further results of an investigation of the monotreme skull." The Hague. I. Palate. Koninklijke Akad. van Wetenschaffen te Amsterdam. Proc. Sect. of Sciences. Vol. III., pp. 130-133. (June, 1901.) *Ibid.* (July, 1900), pp. 81. Zool. Mr. Hubrecht presents on behalf of Dr. J. F. Bemmelen "The results of comparative investigations "concerning the palatine, orbital, and temporal regions of the Mono-"treme skull." (This paper preceded the one last given.) *Ibid.* (pp. 405-407). Third note concerning detail of the Monotreme skull. The Hague. Comm. by Prof. A. A. W. Hubrecht. (Ethmoid and maxillo-turbinate). On p. 133 of the June, 1901, paper, there is presented a figure of "Echidna hystrix; floor of the cerebral cavity, "left side, inner aspect, 2/1." (This is an excellent wash drawing, giving bones, sutures, etc.) On pp. 405-407 in this series, the writer quotes O. Seydel and W. N. Parker "On some points in the struc-"ture of the young *Echidna aculeata.*" (P.Z.S., 1894.) He also quotes Symington's paper "On the nose, the organs of Jacobson, "and the dumb-bell-shaped bone in the Ornithorhynchus." P.Z.S., 1891, p. 575. (See also Gegenbaur, Harwood-Wiedermann and Zuckerkandl.) See also Verhandlungen des V. Inter. Zool. Cong. zu Berlin, vom. 12-16 Aug., 1901, pp. 596-597. (Discussion). "Ueber das "Ospraemaxillare der Monotremen." Von J. F. van Bemmelen.

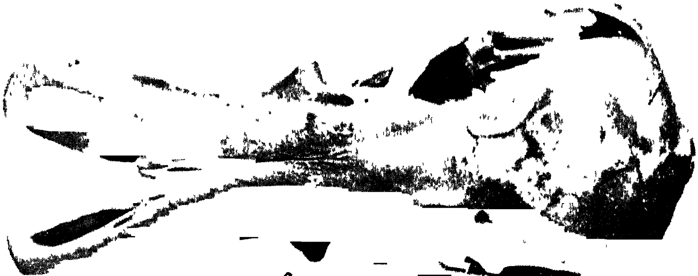

fig. 3.

fig. 6.

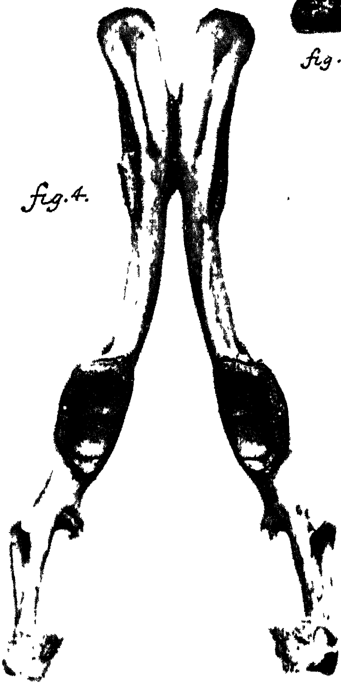

fig. 4.

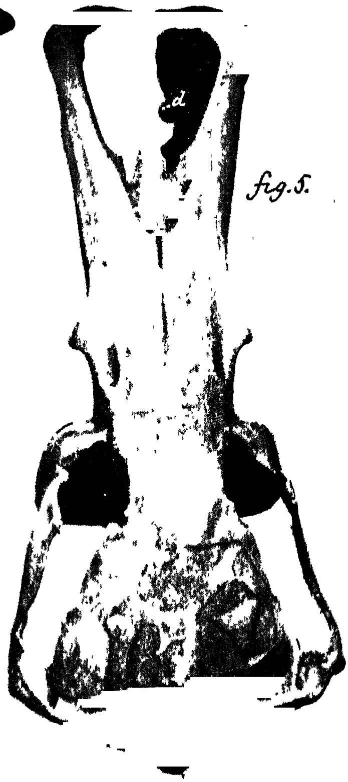

fig. 5.

edition of Flower's *Osteology of the Mammalia.* To be sure, there are a great many special monographs on the skeletology of mammals that are constantly consulted in this line of investigation; but these are not in the same class with a *manual* on the subject—one that essays to give succinct accounts of the bones of the skeleton of mammals in general, such as do the two works mentioned above.

The Skull in the Adult Duckbill:—As has already been pointed out by a number of writers on this part of the skeleton in *Ornithorhynchus*, the sutures among the several bones composing it are almost entirely obliterated in the adult, and this is distinctly the case with respect to the skulls of these specimens in the Army Medical Museum. Owen gives us the superior view of the skull of a young Duckbill, wherein the sutures among the bones are in evidence, and it is a very useful cut. (Fig. 205, p. 321).

At *d* in Figures 5 and 9 we have a full view of the much discussed "dumb-bell shaped bone" of authors. Owen speaks of this as a "small prenasal ossicle" (p. 322); while Flower states that "There is a distinct median dumb-bell shaped "ossification in the triangular interval between the diverging "premaxillary bars, placed in front of the anterior extremity "of the mesethmoid cartilage, on the palatal aspect of the "jaw. This bone is not the homologue of the so-called pre-"nasal of the Pig"; but "it corresponds with that part of "the intermaxilla which lies between the incisive canal and "the mesial palatal suture." (6) (Pp. 243, 244.)

The distal ends of the *premaxillaries* are turned inwards, toward each other and almost at right angles, the interval being about a centimetre. This interval is spanned by a strong, flat ligament, and it is joined, posteriorly, by another ligament, running from the dumb-bell-shaped bone in the median line as shown in Figure 5 of Plate XIX.

On the ventral aspect of the anterior moiety of either maxillary, there is, upon either side, a very shallow, longitudinal groove about two centimetres in length. Horny, pseudo teeth are attached to either of these as shown in Figure 9 of Plate XX. The far more formidable pair is situated considerably further back, each occupying the ventral surface of a *maxillary* upon either side. In the dried skull these structures can easily be pried off, whereupon

(6) TURNER, W.—"The dumb-bell-shaped Bone in the Palate of Orni-"thorhynchus compared with the prenasal Bone of the Pig." (Journ. Anat. Phys., XIX., 1885, p. 214.)

ALBRECHT, P.—"Sur la Fente Maxillaire et les quatre Os Intermaxil-"laires de l'Ornithorynque." Bruxelles, 1883.

each has the appearance of Figure 6 of Plate XIX. They take the place of the molar teeth, which, as Flower states, upon either side rest upon the zygomatic process of the maxilla, which is widened inferiorly into an oblong, concave, roughened surface for their attachment. Owen claims that *Ornithorhynchus* has no true malar bone. (P. 822.)

Viewed superiorly, it will be seen that for the most part the cranium of this monotreme is smooth and flat, especially the part anterior to the orbits. There is a conspicuous foramen, on either side, piercing the nasal with a groove leading from it to the front. Laterally, and opposite the broad, thin, and transversely compressed zygoma, the side of the cranium is marked by the temporal fossa; it is shallow, and of equal depth throughout its extent. The narrowest part of the cranium is immediately anterior to this fossa. In the post-basitemporal region there is a pair of large, elliptical foramina, with another smaller pair between them and the posterior nasal apertures.

Between the molar teeth, the surface of the basis cranii is smooth and concaved. On either side may be seen the posterior palatine foramina (Fig. 9), which, next to the interorbital diameter, is the narrowest part of the face. This latter is much flattened, and from behind, forwards, becomes gradually broader, to terminate distally as described in a previous paragraph and here well shown in Figure 5 of Plate XIX. "The infraorbital foramen," as Flower points out, "is "very large, corresponding to the large size of the nerves "distributed to the sensitive sides of the beak. The periotic "has a wide and deep floccular fossa."

The skull belonging to skeleton No. 2639 of the Army Medical Museum has long been broken in two—a fracture that now admits of a view of the interior of the brain case through the absence of the entire anterior wall.

With respect to the general form of the cranial casket, the figures on the plates present more than can be gained through any amount of description. In its interior there is to be noted, however, the small olfactory fossa, pierced at its base by twin foramina, placed side by side transversely. The anteriorly concaved wall rises behind this, the outer angles of which exhibit well developed, posterior *clinoid processes.* Falx cerebri are faintly pronounced and well ossified, especially the postero-median one, which is more or less prominently produced. There appear to be considerable differences in the outline of the *foramen magnum* of the *Ornithorhynchus;* for in the smaller specimen of these tw


fig. 7.
fig. 8.
fig. 9.
a

(2639) this is broad and elliptical, with the major axis horizontal, while in the other specimen it is almost circular. More than this, in the first specimen mentioned there is a well-marked "supraoccipital foramen" present, which is pierced by an elliptical foramen, placed vertically, that opens mesially below by an extremely narrow strait into the superior arc of the foramen magnum. At either side of the cranium the *glenoid fossa* is very pronounced and markedly concave transversely.

As Owen has pointed out, "the *vomer* forms a bony, ver-"tical septum, dividing the nasal cavity from the presphenoid "forward."

Whoever prepared these Army Medical Museum specimens failed to preserve the *hyoidean apparatus* in either of them, so no description of it can be furnished here. Sir Richard Owen does not appear to have described this for either the Echidna or the Duckbill; while Sir William H. Flower, in his "Manual," gives a very excellent cut of the lower surface of the hyoid of the Echidna *(E. aculeata)*, and briefly describes it in the text (pp. 242, 243). At this writing I have not at hand a figure and description of the hyoid in *Ornithorhynchus*.

Figures 4, 7, and 8 of the accompanying plates present the three principal views of the *mandible* of the Duckbill; and these, taken in connection with the admirable description by Owen of this remarkable bone (p. 321), leave practically nothing to be desired on this point.

The Shoulder-girdle and Sternum:—Both Owen and Flower, in their above-cited work, give quite full accounts of the *shoulder-girdle* and *sternum* in an Echidna and the Duckbill; these accounts are illustrated for the last-named animals, the differences being given in the text. Upon carefully comparing these two descriptions with the corresponding bones of the skeletons at hand, I find that they practically agree in all essential particulars. These parts, in fact, have long been known to comparative anatomists—that is, since Flower published on the subject, for Owen's description is very meagre and unsatisfactory.

Attention is invited to the different way in which the *scapulæ* have been mounted in the two skeletons of the Duckbill. The bones are far apart in No. 1304, while in No. 2639 the upper thirds of these bones have not only been brought, upon either side, flat against the cervical ribs, but actually *wired* in that position. It would appear from the articulations that neither of these is quite correct, and doubtless it is

a point that can only be settled through an examination of an adult specimen in the flesh. Personally, I very much doubt that the bones are closely adpressed to the cervical ribs as in the skeleton 2639 (see Fig. 11 for the Echidna).

"In the Monotremata the *Ornithorhynchus*," says Flower, "has a broad presternum, with a small, partially "ossified *pro-osteon* in front of it; three keeled mesosternal "segments, which commence to ossify in pairs, and no xiphi- "sternum, which in *E. bruijni* consists of three metameric "portions.

"The T-shaped bone, *interclavicle* or *episternum* in front "of the presternum, which connects it with the clavicle and is "often completely fused with it, appears to have no homo- "logue among the other Mammalia, and belongs more pro- "perly to the shoulder-girdle than to the sternal apparatus" (pp. 104, 105).

The Vertebral Column and Ribs:—Judging from the accounts of various anatomists, the vertebræ and the ribs in the Echidnas and the Duckbill are subject, with respect to number, to very considerable variation in different individuals. (7)

In the work of G. P. Frets, cited above, there are tables presenting the great variation in the number of vertebræ in the Echidna—and so it goes for other authorities.

Flower gives us the following table (p. 89):—

MONOTREMATA.

Species.	Cervic.	Thorac.	Lumb.	Sacral	Caudal
Echidna—					
Aculeata . . .	7	16	3	4	11
Bruijni	7	16	4	3	10
Ornithorhynchus anatinus	7	17	2	3	20

Owen makes a brief statement to the effect that "both "the genera have twenty-six 'true vertebræ,' of which seven "are cervical; but the Ornithorhynchus has seventeen and "the Echidna sixteen dorsals, the lumbar vertebræ being "three in the latter, and reduced to the lacertian number two "in the *Ornithorhynchus*," to which statement he makes no exceptions (p. 316).

(7) BROWN, R., M.B., B.Sc.—"Note on an Echidna with eight vertebræ." *Proc. of the Linn. Soc. of New South Wales*, 1900. Vol. XXV., Sydney, 1901. One cut. "Dorsals vary from 14 to 17; lumbars 2 to 4; "sacrals 3 to 4; caudals 10 to 14." This authority also gives some important notes on the *ribs* of the monotremes.

fig. 10.

Owen further states that "the sacrum consists of two "vertebræ in *Ornithorhynchus* and three in the *Echidna*. "There are thirteen caudal vertebræ in the Echidna, Fig. "201. The first is the largest, with broad transverse pro- "cesses, the rest progressively diminishing, and reduced, in "the six last, to the central element. The *Ornithorhynchus*, "Fig. 199, has twenty-one caudal vertebræ, of which all but "the last two have transverse processes, and the first eleven "have also spinous and articular processes" (p. 317). The cuts cited are the old figures that illustrated Owen's article on the Monotremes in the third volume of the *Cyclopædia of Anatomy* (1841); they are very crude, especially the one of the Echidna, wherein the number of vertebræ do not agree with the number for the Echidna given in the text, and the cervico-dorsal regions of the spine are altogether too straight.

Flower, in his above cited table, points out that one species of Echidna has eleven caudal vertebræ, and another ten; while in the text in the same work (p. 77) he says:— "The Echidna has 12 caudal vertebræ." Again, in the table, he states that the *Ornithorhynchus* has 20 caudals, while in the text—same page—he informs us that this monotreme "has 20 or 21 caudal vertebræ."

On page 68 he again says that "the Ornithorhynchus has "2 ankylosed sacral vertebræ, and the Echidna 3 or 4." In the table he gives the Ornithorhynchus 3 sacral vertebræ. These discrepancies occur throughout the literature of the subject.

Turning to the vertebræ and ribs of these three Army Medical Museum specimens (Figs. 1, 2, 10, and 11), we find, in the specimen No. 1304, 17 pairs of ribs, the six anterior ones of which articulate with the sternum through sternal or costal ribs. The leading pair of these costal ribs articulate with the extreme outer angles of the presternum; while the last pair, which are very thick for their anterior moieties and more or less flattened posteriorly, articulate with the ultimate joint of the true sternum. Following these, we have 8 ribs that articulate below with costal ribs, the latter being free, very broad, and compressed from above, downwards. Finally, in the last three pairs of these thoracic ribs are "floating ribs," the last pair being but half the length of the first pair, while the midpair is intermediate in length between these and the first pair. This specimen has *seven* cervical vertebræ; seventeen dorsals; two lumbars; four sacrals; and twenty caudals (counting the terminal one which has been lost).

Turning to the smaller skeleton of these two Duckbills (No. 2639), it is to be noted that the sternal and costal ribs and the vertebræ agree entirely with those of No. 1304, with respect to number and characters.

In his *Osteology of the Mammalia*, Flower has quite fully described the vertebræ of the entire spinal column in the Echidna and the Duckbill; and I find that the specimens here under consideration in no way depart from those descriptions. In these two specimens of *Ornithorhynchus* the *odontoid process* has thoroughly united with its proper vertebræ, which is very good evidence that they are well along in life; and notwithstanding the fact that No. 1304 is much the larger of the two, both having highly developed *spurs* would point toward their both being males.

The *Skull* in the Echidna at hand departs in no way from the descriptions of that part of the skeleton as given by Flower, Owen, and other eminent comparative anatomists, and this is also true of the *sternum* and *shoulder girdle*. The general outline of an Echidna's skull is well shown here in Figures 10 and 11. It is noted for its very feeble and delicately constructed mandible and the general lack of character of the cranium, which is quite devoid of the usual salient apophyses, marked fossæ, and conspicuous foramina.

In the *Ornithorhynchus* the sacrum is of much feebler build than it is in the Echidna, while in both its hinder portion makes an acute angle with the chain of caudal vertebræ. All that Owen has to say about this bone is that "the "sacrum consists of two vertebræ in the *Ornithorhynchus*, "and of three in *Echidna*" (p. 317).

As all three of these skeletons are of adult specimens, it is not possible to decide whether in any of them an *os acetabuli* is present or not. Flower evidently entertained the opinion that the Monotremata lacked this "fourth pelvic "bone," and says of it in general that "its morphological "meaning is as yet unknown, but it can scarcely be consid- "ered as an epiphysis." This authority's description of the *pelvis* in the monotremes agrees with that bone as exemplified in these Army Medical Museum skeletons; he states that "in "the *Monotremata* the pelvis is short and broad. The ilia "are short, distinctly trihedral and everted above. The "ischia are large, and prolonged into a considerable back- "ward-directed tuberosity. The symphysis is long, and "formed about equally by pubes and ischium. The thyroid "foramen is round. The acetabulum is perforated in *Echidna* "as in birds, but not in *Ornithorhynchus*. The pectinal

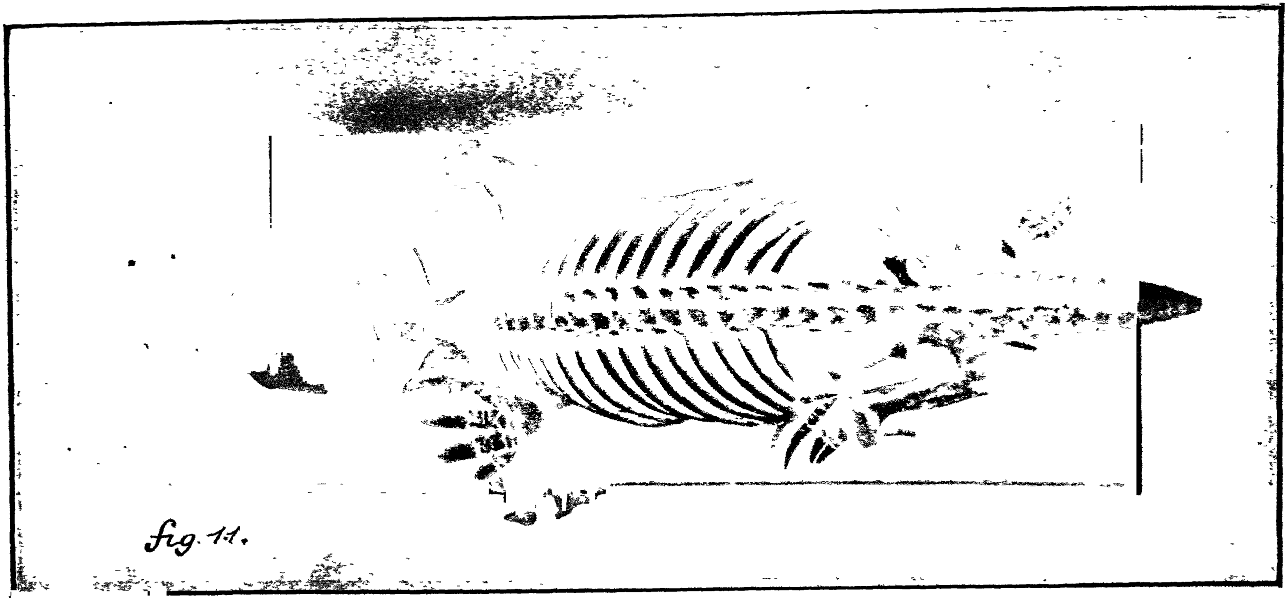

fig. 11.

"tubercle is greatly developed. There are large 'marsupial' "bones in both genera." These in *Echidna* are longer, narrower, and more divergent than they are in the Duckbill, where they are triangular and broad at their bases. The *sacral vertebræ* fuse with the pelvic bones in these monotremes, and the suture of the pubic symphysis is almost obliterated.

The *Bones of the Limbs* in the *Ornithorhynchus* and the *Echidna* are very fully and quite accurately described by Owen (pp. 323-328), while Flower gives us scarcely anything on the long bones of the pectoral and pelvic limbs, having devoted the most of his space and descriptive matter to *manus* and *pes*, the bones of which are touched upon more or less fully.

In another connection later on it is my intention to take up more in detail some of the special skeletal characters, as exemplified in the *Monotremata*—that is, those that do not fall especially within the scope of the present contribution.

LEGENDS FOR THE FIGURES.

Plate XVIII.

Fig. 1. Left lateral view of the skeleton of an adult *Ornithorhynchus anatinus*, No. 2639, Army Medical Museum Collection; male; reduced.

Fig. 2. The same skeleton as shown in Fig. 1, seen directly from above.

Plate XIX.

Fig. 3. Superior view of the skull of the specimen of the *Ornithorhynchus* shown in Figure 1 of Plate XVIII. (No. 2639, Army Medical Museum Collection.) Lower mandible removed. Zygoma of right side missing. Reduced.

Fig. 4. Mandible of the adult *Ornithorhynchus* viewed directly from above; reduced; male. Specimen No. 1304, Army Medical Museum Collection.

Fig. 5. Superior view of the skull of an adult male *Ornithorhynchus anatinus*; reduced. Specimen No. 1304, Coll. Army Medical Museum. This is the skull to which the mandible here shown in Figure 4 belongs. The "dumb-bell-"shaped" bone is plainly shown at *d*, between the premaxillary bones, which latter are nearly out of sight below the nasals.

Fig. 6. Horny "tooth" from the left side of the mandible of the specimen shown in Figures 1 and 2 of Plate XVIII.; reduced; superior aspect.

PLATE XX.

Fig. 7. Right lateral view of the skull and detached mandible of an adult male *Ornithorhynchus anatinus*. Specimen 1304 Collection Army Medical Museum. Compare with Figure 4 of Plate XIX. (above), Figure 8 of this Plate for the mandible, and Figures 5 and 9 for the skull.

Fig. 8. Inferior or ventral aspect of the mandible shown in Figure 7; reduced. (See Fig. 4, Plate XIX.)

Fig. 9. Ventral view of the skull of *Ornithorhynchus;* reduced. Same skull as shown in Figure 5 of Plate XIX. (Collection Army Medical Museum.)

PLATE XXI.

Fig. 10. Left lateral view of the skeleton of an *Echidna* (*Tachyglossus*) *aculeata*. Sex? Slightly less than one-half natural size. No. 2639, Coll. Army Medical Museum.

PLATE XXII.

Fig. 11. Direct view from above of the skeleton of an *Echidna* (*Tachyglossus*) *aculeata*. Slightly less than one-half natural size. Same specimen as shown in Figure 10 of Plate XXI. of the present article.

THE PROGRESS OF GEOLOGICAL RESEARCH IN TASMANIA SINCE 1902.

By

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[Originally written for the Hobart-Melbourne Meeting of the Australasian Association for the Advancement of Science, January, 1921.]*

(Read before the Royal Society of Tasmania, 8th August, 1921.)

I. INTRODUCTION.

On the occasion of the last meeting of this Association in Hobart the late W. H. Twelvetrees presented a paper entitled "The Outlines of the Geology of Tasmania." A period of eighteen years has elapsed since that paper was prepared, and a great advance has been made in our knowledge of the geology of Tasmania during that interval. It, therefore, seems desirable to take the opportunity afforded by the re-assembly of the Association in Tasmania of summarising our progress—to take stock of our knowledge and to see what problems still await solution.

It must be stated at once, however, that in spite of the great amount of work accomplished during the period under review, the result, when viewed in relation to the complete geological survey of Tasmania, is to some extent disheartening. This was particularly apparent when the preparation of the Geological Sketch Map of Tasmania was undertaken in 1914 by the Geological Survey of Tasmania. When there had been plotted on the base map the geology of the areas of which geological surveys had been completed, the greater portion of the State still remained blank, and to produce the map as ultimately published, the information contained in R. M. Johnston's original geological map was utilised with sundry modifications. The reason for this is easy to see, for the conditions under which the Geological Survey carries out

*Owing to the Shipping Strike the meeting of the A.A.A.S., which was to have been held in Hobart in January, had to be held in Melbourne. As a consequence, numerous difficulties had to be overcome. It was found impossible to bring out the usual Report of the A.A.A.S. meeting, and print all papers. Arrangements were, therefore, made for certain papers to be read before the Society and published in the Papers and Proceedings for 1921.

its work are such as to necessitate detailed investigations of limited areas, rather than cursory examinations of larger areas. It must be remembered that the *raison d'etre* of the Geological Survey is the demand of the Mining Industry for reports on mineral and coal deposits, and the portions of the State subjected to such detailed geological examination are almost wholly confined to our mineral and coal areas. With the ever-growing demand for examination of mining fields it has not been possible to pay much attention to the general geology of the remainder of the Island.

It is not intended to imply that this intensive examination of limited areas is undesirable. In fact, these detailed investigations are essential to the ultimate elucidation of the factors controlling ore-deposition in Tasmania, and they have already enabled important deductions to be made regarding certain important phases of general geology. The only disappointing feature in regard to them is that indicated above in relation to the areal geology of the Island.

Before proceeding to deal with the actual progress in the various branches of geology recognition must be given to those whose work has made this progress possible.

It is with mixed feelings of admiration and regret that the writer mentions the name of the late W. H. Twelvetrees —admiration for the great work he accomplished, and regret that he was not spared to be present at this meeting and to be still amongst us. He had looked forward to this meeting since before its first postponement, and it would have been very fitting if this summary could have been presented by him, as it deals very largely with the achievements in geological research by himself and those working under his genial and able direction. For twenty years the late W. H. Twelvetrees occupied the position of Government Geologist of Tasmania, and for seventeen years of the eighteen covered by this review he directed the acquisition of our knowledge of the geology of Tasmania. It was he who was responsible for the initiation of systematic geological surveys of definite areas in place of the restricted examinations of mining prospects—a change beneficial both to geological science and to the mining industry. The contributions by this indefatigable worker to our knowledge embrace all of the branches of geology, but, perhaps, his greatest achievements were in the domain of petrology. The geological literature of Tasmania has been greatly enriched as the result of his labours, and Tasmania undoubtedly must ever remain indebted to him, his example, and his memory.

Important contributions to our knowledge were made by G. A. Waller, who was Assistant Government Geologist from 1901 to 1904. In addition to his valuable descriptions of many of our ore deposits and his pioneer work on their genesis, this enthusiastic worker did much to advance our knowledge of the stratigraphy of the Lower Palæozoics on the West Coast, as well as succeeding in throwing much light on the petrology of the associated igneous rocks.

L. Keith Ward, B.A., B.E., during the time he occupied the position of Assistant Government Geologist from 1907 to 1911, was responsible for very great progress in geological research in Tasmania. Immediately after his appointment to the Survey there was instituted the present series of Geological Survey publications which is in accordance with the system in vogue in modern Geological Surveys. His own contributions to this series of publications set a very high standard both as regards literary merit and method of treatment. The thoroughness of his investigations and the illuminating conclusions he drew therefrom have great value both from the importance of the acquired information itself and from the fact that his conclusions and hypotheses supply an invaluable method of approach to many of our petrologic and metallogenic problems.

The work performed by L. L. Waterhouse, B.E., Assistant Government Geologist from 1912 to 1916, has also added to our knowledge. The detailed descriptions contained in the two bulletins prepared by him supply a wealth of information concerning the two areas with which they deal. To this investigator there is undoubtedly due the credit of throwing much light on the detailed petrography of our Devonian granites, and their contact metamorphic deposits, as well as considerable information concerning the factors controlling tin deposition in Tasmania.

To this enumeration of former officers of the Geological Survey of Tasmania, who have materially advanced our knowledge, mention must be made of the present officers of that organisation who are at work on important geological problems. The writer joined the Department in 1912, on the occasion of an increase in the staff of the Survey. Mr. A. McIntosh Reid joined the Geological Survey in 1917, and, together with Messrs. P. B. Nye, B.M.E., and H. G. W. Keid, B.Sc., who were appointed early in 1920, are actively engaged in conducting geological surveys according to the programme authorised by the Honourable the Minister for Mines for Tasmania.

Passing now to those who have contributed towards our knowledge from outside the ranks of the Geological Survey, the name of the late R. M. Johnston, I.S.O., must first be mentioned. The death (in 1918) of this investigator deprived Tasmania of one of her pioneer geologists, and one to whom we are indebted for a great part of our knowledge in regard to the stratigraphy of the Permo-Carboniferous and later systems.

To the late Thos. Stephens, M.A., who died in 1913, we owe appreciable additions to our knowledge of the general geology of the State.

The Grim Reaper has also deprived us of that indefatigable worker in the realms of mineralogy and petrology—the late W. F. Petterd, whose demise took place in 1910. His "Catalogue of the Minerals of Tasmania," published by the Mines Department in 1910, is still the standard work on this subject. In collaboration with the late W. H. Twelvetrees, the late W. F. Petterd contributed largely to our knowledge of the petrography of Tasmanian igneous rocks.

To Professor Sir T. W. Edgeworth David, K.B.E., C.M.G., D.S.O., D.Sc., we are indebted for much advice during the researches of this period under review, as well as for contributions to the literature on the Permo-Carboniferous and Pleistocene glacial geology of Tasmania.

In 1903 Professor J. W. Gregory, D.Sc., visited the West Coast, and his description of the geology and ore-deposits of Mount Lyell, and several other papers on the physiography and glaciation of that portion of Tasmania are valuable additions to our literature.

To Professor E. W. Skeats, D.Sc., is due the credit of definitely determining the Tertiary age of the Port Cygnet alkaline rocks.

Important work on palæontological questions was carried out by W. S. Dun, especially in connection with the age classification of the upper and lower palæozoics. Record No. 1 of the Geological Survey of Tasmania is the work of this palæontologist.

In this domain of palæontology A. F. Chapman, of the National Museum, Melbourne, has assisted us to a great degree in making determinations, and one of his contributions has been published as Geological Survey Record No. 5.

H. H. Scott, Curator of the Victoria Museum, Launceston, has carried out very valuable researches on *Nototherium tasmanicum*, and the results of his labours are embraced by Geological Survey Record No. 4, and that very creditable

restoration of the skeleton in the Victoria Museum, Launceston. During the past year this keen investigator, in collaboration with Clive Lord, of the Tasmanian Museum, Hobart, has started the systematic description of *Nototherium mitchelli*, which is the latest discovery in this direction, and the mounted skeleton now on view in Hobart is the work of H. H. Scott.

The late Colonel R. V. Legge did much to increase our knowledge of the topography of Tasmania, particularly the north-eastern portion. His death in 1913 removed another valuable worker in the field of geology.

Professor W. N. Benson, D.Sc., besides contributing towards our petrographical knowledge of our granites and alkaline series, has helped towards the elucidation of the problem of pleistocene glaciation by publishing a study of the Cradle Mountain portion of our highlands.

In addition to these workers in the various branches of geological research, the following have from time to time contributed towards our knowledge:—Fritz Noetling, M.A., Ph.D.; Hartwell Conder, M.A., A.R.S.M.; W. H. Clemes, B.A., B.Sc.; Griffith Taylor, D.Sc., B.A., B.E.; E. C. Andrews; R. C. Sticht; Hyman Herman; H. S. Summers, D.Sc.; Rev. H. H. Anderson, M.A.; Rev. E. D. Atkinson, B.A.; F. Osann; H. Rosenbusch; W. A. MacLeod, B.Sc.; O. E. White; F. P. Paul, Ph.D.

It is thus apparent that the greatest of our unofficial workers have passed the Great Divide, and that the number remaining is lamentably small. Particularly it is noticeable that the number of our Tasmanian observers is limited to two or three—a fact which is much to be regretted, and which must delay the advance of our knowledge to a considerable degree. This lack of geological observers is, in the writer's opinion, very largely due to the fact that for some years past the University of Tasmania has neither provided instruction in the subject of Geology nor held examinations therein, owing to shortage of funds. This neglect of a subject which must inevitably play a very important part in the development of our natural resources is much to be regretted, and every effort should be made to initiate a school of geology at the University. The failure of the University authorities to give this subject the attention which it deserves, both from the utilitarian point of view and from its undoubted educational value, is reflected in our secondary schools, for in the public examinations held last year only two candidates presented themselves for examination in

Geology. Under such conditions it is not to be wondered at that there is such a paucity of observers with sufficient knowledge to make observations of value.

The conditions existing in Tasmania at present are, therefore, such that the work of investigating the complex geology of the Island devolves entirely on the Geological Survey. With practically no help from outside, and because of the complexity of our problems, the inclement climatic conditions, the rugged topography, and the heavy forest growth, our progress must be somewhat slow.

II. PHYSIOGRAPHY.

The advance in this branch of geology has been considerable, but we are still far from a complete understanding of the evolution of the topographic features of Tasmania.

As a matter of fact, there has not yet been produced a topographic map of Tasmania of even approximate accuracy. The existing map of Tasmania is admittedly inaccurate to a marked degree. In fact, there has not yet been completed a trigonometrical survey of the State, as although such a survey was started many years ago, it had not been nearly completed before work on it was suspended, and has not been resumed to date.

The most detailed maps available are the Mineral and Land Charts, which show boundary lines of sections and some of the principal streams and occasional mountain peaks, but even these latter details are to some extent unreliable.

The necessity, therefore, arises of mapping the topography concurrently with the geology in carrying out the work of the Geological Survey. In 1909 the late W. H. Twelvetrees endeavoured to arrange for the addition of a topographer to the Geological Survey staff, but was unsuccessful. The geologists of the Survey, therefore, are compelled to map topographic features as far as opportunity allows or necessity dictates. Under these conditions progress must necessarily be slow.

To Professor J. W. Gregory is due the credit of first recognising the peneplain on the West Coast, which has been so deeply dissected as to make its recognition difficult. The work carried out by the various officers of the Geological Survey since Professor Gregory first drew attention to it has shown that this peneplain extends from northwards of Port Davey to the Mersey River, over an area roughly crescentic in shape, varying in height from 200 to 2,000 feet above sea-level, and having a slope of from 40 to 100 feet

per mile. Its age is certainly Pre-glacial, but its relation to the Tertiary basalts has not been satisfactorily demonstrated.

The Central Plateau is clearly a horst as regards its northern, western, and southern precipitous slopes, but recent work by P. B. Nye, B.M.E., has shown that the eastern face is not a fault scarp, but is due to the upthrust of a huge transgressive diabase mass. The work of this investigator in the Midlands has demonstrated that the Midland plain is not a rift valley, as maintained by E. C. Andrews and Dr. Griffith Taylor, but that the diabase masses on either side of this plain are in the approximate positions relatively to the similar rock of the plain which they assumed when originally intruded. It seems, therefore, that the horst must embrace portion of the Eastern Highlands, since undoubted block faulting occurs towards the East Coast. It is hoped that the geological surveys of the East Coast coal-fields at present in progress will definitely settle this question.

A considerable amount of work has been done on the problem of our Pleistocene glaciation, but as this is dealt with in a special report by the Glacial Sub-committee, there is no need to repeat a description of it. Suffice it to say, that a number of glacial cirques have been located and described, as well as lakes of glacial origin, and the maximum descent of the glaciers determined to be 460 feet above present sea level.

Some advance has been made in our knowledge of the Recent oscillations of sea-level on the North and West Coasts, but we are far from being able to outline these with any degree of accuracy. The work of E. C. Andrews, Charles Hedley, and Fritz Noetling must be acknowledged in this connection.

III. STRATIGRAPHICAL GEOLOGY.

(1). PRE-CAMBRIAN.

Since the late W. H. Twelvetrees presented a summary of our knowledge of Tasmanian Pre-Cambrian geology before this Association in 1907, there has been some definite advance in our knowledge. This advance resulted mainly from two exploratory journeys made in 1908 and 1909 by the late W. H. Twelvetrees, in conjunction with L. K. Ward, B.A., B.E., on the route of the proposed Great Western Railway.

In the description of these Pre-Cambrian rocks presented by L. K. Ward, in a paper read before The Royal Society of Tasmania in 1909, the age determination is based on the

well-determined fact that they underlie with a marked unconformity the West Coast Range Conglomerate series, which was regarded by Ward as of Lower Cambrian age. It has subsequently been demonstrated, however, that this West Coast Range Conglomerate series is the basal conglomerate of the Silurian System, so that the observed stratigraphical succession gives no more definite age determination than that of Pre-Silurian. The only occurrence *in situ* of rocks of Cambrian Age in Tasmania is that of the Dikelocephalus sandstone near Railton, but as the exact relationship between this series and any other rock series in the vicinity has not been demonstrated, there must be some doubt as to the Pre-Cambrian Age determination. Certainly, the very fresh character of the Cambrian sandstone as compared with the schistose character of the rock series referred to as Pre-Cambrian is suggestive, and the Pre-Cambrian age determination is largely based on lithological character.

That the reference of this rock series to the Pre-Cambrian is most probably correct is indicated by the fact that the following is the definitely ascertained succession:—

Silurian.—West Coast Range Conglomerate Series.
Diastrophic Period and Erosion Interval.

Cambro-Ordovician. — Porphyroid Igneous Complex.
Diastrophic Period and Erosion Interval.

Pre-Cambrian (?).—Quartzites and Mica-Schists.

Accepting their Pre-Cambrian age, L. K. Ward refers them to the Algonkian, and subdivides them into an Upper and Lower Series—the upper consisting of a relatively gently folded series of white quartzites, and the lower series of intensely crumpled mica and quartz schists, the two being separated by an unconformity. In the vicinity of Point Hibbs the mica-schists contain intercalated beds of dolomitic limestones, this being the only locality in Tasmania where calcareous beds are known to occur in the Pre-Cambrian.

The areas occupied by these rocks have been indicated in the latest geological map of Tasmania. Their greatest development is in the south-western portion of the Island, although isolated areas of much lesser extent occur on the west, north-west, and north coasts. The late W. H. Twelvetrees estimated the total thickness to be 13,000 feet, but in view of the fact that the structural geology has not been

worked out in even approximate detail, this must be regarded —as the author of it himself regarded it—as a tentative approximation.

(2). CAMBRO-ORDOVICIAN.

It is in this system and in the succeeding Silurian system that the greatest progress in Tasmanian stratigraphy has been accomplished during the period under review.

In 1902 the late T. S. Hall described some graptolites from the slates in the Dundas district, and determined them as being Ordovician types. Unfortunately, however, there is some doubt in regard to the reliability of this determination in fixing the age of the Dundas slates, for repeated search, both at the locality whence Hall's specimens were supposed to have been procured and elsewhere in the series, has signally failed to provide another specimen. Undoubted Ordovician graptolites have been found in the Permo-Carboniferous glacial till at Wynyard, but with the above exception of the late T. S. Hall's specimens no graptolites have been discovered *in situ* in Tasmania, in spite of diligent search.

The Dundas slate and breccia series, of which the typical rock-type is a finely fissile purple slate, underlie with a marked unconformity the slates and sandstones definitely determined as Silurian. They are similarly definitely established as unconformably overlying the mica-schists to which a Pre-Cambrian age has been ascribed. The series then is either Cambrian or Ordovician in age, and owing to the failure to obtain information of the Ordovician determination by the discovery of further graptolites, it is at present preferred to refer to them as of Cambro-Ordovician age.

To this dual system are also referred the following rock series named after the localities in which the chief development of each occurs:—

Read-Rosebery Schists.

Balfour Slates and Sandstones.

Mathinna Slates and Sandstones.

These three series have been described in some detail. The Read-Rosebery schists have been dealt with somewhat fully by the writer in Bulletins 19 and 23 of the Geological Survey. These schists, the origin of which was previously very obscure, have been now demonstrated to have been mainly sedimentary in origin, pyroclastic material constituting what is not purely sedimentary. Their structural fea-

tures have been mapped in detail, and their relation to the felsites and keratophyres of the porphyroid igneous complex definitely determined, for the mapping of the structural features has shown that the felsites and keratophyres overlie them as effusive lava sheets which have been involved in the same orogenic movement which produced the folds and the schistosity in the schists. It has further been demonstrated that the Read-Rosebery schists conformably overlie the Dundas slates and breccias. The Dundas slates and breccias, the Read-Rosebery schists, and the felsites and keratophyres constitute in fact a conformable series, having the above ascending order of succession, composed of mixed sediments, pyroclastic accumulations, and effusive lava flows. The evidence further goes to show that some at least of these lava flows were submarine.

The Balfour slates and sandstones have been described by L. Keith Ward in Geological Survey Bulletin No. 10. They present many similarities to the Dundas slates, but the relationship with this latter series has not been determined. They are wholly sedimentary rocks, the pyroclastic members of the Dundas slates and breccias being absent. They have up to the present yielded no fossil remains whatever. Similarity of structural features and the close resemblance between certain rock-types of both series seem to indicate that we here have two members of a great sedimentary system.

The Mathinna slates and sandstones, which have been described by the late W. H. Twelvetrees in his reports on the Mathinna field, closely resemble the Balfour slates and sandstones in lithological character and structural features. Although widely separated geographically, they are probably parts of the same sedimentary system. Like the Balfour series, they are apparently unfossiliferous.

(3). SILURIAN.

In the account of the Geology of Tasmania presented by the late W. H. Twelvetrees before this Association in 1902, the whole of the metamorphosed igneous rocks now referred to as the Porphyroid Igneous Complex, together with the Read-Rosebery and Mt. Lyell schists as well as the Dundas slates and breccias, were referred along with brachiopod sandstones at Middlesex, Zeehan, and Queen River to the Upper and Middle Silurian. The Gordon River limestone, together with the Mathinna slates and sandstones were referred to the Lower Silurian.

Since that date it has been satisfactorily demonstrated that the Porphyroid Igneous Complex, the Read-Rosebery and Lyell schists, and the Dundas slates and breccias are separated from the Silurian sedimentary rocks by a period of very pronounced diastrophism. As explained above, these older rocks are referred to as Cambro-Ordovician. The series which are now definitely recognised as belonging to the Silurian system are the slates and sandstones of the Queen River, Zeehan, and Middlesex, and other localities on the West Coast; and the blue limestone, generally known as the Gordon River limestone, but which occurs at numerous localities throughout Northern, Western, and Southern Tasmania. Suites of fossil remains from these series have been examined by W. S. Dun, whose final conclusion was to the effect that the species of the various genera were of Silurian types, but possessed to some extent an Ordovician facies. On the whole, however, this palæontologist concludes that both series are of Silurian age, and most probably Lower Silurian.

And now it is necessary to mention a sedimentary series which is such a prominent factor in West Coast geology, and which has been the subject of much discussion and investigation, being within the last 18 years referred to systems ranging from Devonian to Cambrian. The series referred to is the West Coast Range Conglomerate Series. This series was referred by the late W. H. Twelvetrees in 1902 to the Devonian, and L. K. Ward, mainly on negative evidence, transferred it in 1909 to the base of the Cambrian system. The negative evidence referred to consisted of the non-discovery within the conglomerate of pebbles of rocks of the Porphyroid Igneous Complex. The discovery in 1913 by the writer of numerous pebbles of such rocks in the conglomerate series as developed in the Jukes-Darwin field showed the uncertainty of basing conclusions on negative evidence, and finally determined the Post-Porphyroid age of the conglomerate series. Investigations carried out since that time by the writer, and which are still in progress, have supplied abundant confirmatory evidence.

The age of the West Coast Range Conglomerate Series is by this succession shown to be Post-Cambro-Ordovician. The study of the structural geology of this series and the Silurians, which has been carried out in the Zeehan field by G. A. Waller, and by the writer on the greater part of the West Coast Range, serves to strengthen to almost certainty the conclusion arrived at by G. A. Waller in 1903,

that the West Coast Range Conglomerate conformably underlies the Silurian limestone series, and is itself of Silurian age, constituting, in fact, a basal conglomerate series of the Silurian system in Tasmania.

The much-discussed Tubicolar or Pipe-Stem Sandstone belongs to the uppermost horizon of the West Coast Range Conglomerate Series, and is more highly developed in the North than in the more southerly portion of the known occurrences. The limestone immediately succeeds this Tubicolar Sandstone, and is itself conformably overlain by the slates and sandstone series, the Silurian system in Tasmania thus consisting of:—

(3) Slates and Sandstone series of Queen River, Zeehan, Middlesex, etc.

(2) Limestone series of Gordon River, Railton, etc.

(1) West Coast Range Conglomerate series.

(4). DEVONIAN.

There are no sedimentary rocks so far located in Tasmania which can be referred to the Devonian system.

Consequent on the collapse of the geosynclinal in which the Silurian sediments were laid down, there ensued an orogenic period of considerable intensity. This orogenic movement consisted largely of folding, but thrust faulting on a considerable scale was a marked characteristic. It is this orogenic folding and faulting which is responsible for the very complicated relationships between the older rocks and the Silurian sediments which have been the cause of so many misinterpretations of the geological succession.

The final phase of the orogenic period consisted of the irruption of the principal granitic rocks of Tasmania. The fact that the next sediments to accumulate are of Permo-Carboniferous age, and that they rest in many cases directly on the granite, points to the conclusion that during the Devonian period Tasmania was a land surface, and was subjected to a prolonged cycle of denudation. In fact, work recently carried out by the writer has shown that at the close of the Devonian period this land surface had been reduced to a peneplain.

(5). PERMO-CARBONIFEROUS.

An important advance in our knowledge of the Permo-Carboniferous system was made by the late W. H. Twelvetrees in 1911, when he demonstrated that the Tasmanite

shale beds of the Mersey basin were the marine facies of the Mersey (East Greta) Coal Measures. The discovery and investigation of the Preolenna Coal-field have supplied further evidence of the geological horizon of our Lower Coal Measures, and the coal seams and the associated kerosene-shale present much valuable information in regard to sapropelic coals.

The glacial conglomerate forming the base of the Permo-Carboniferous system in Tasmania has been studied in detail by Professor Sir T. W. Edgeworth David at Wynyard.

With these exceptions, the work accomplished on our Permo-Carboniferous system has not been sufficient to give us greater information than we possessed 18 years ago.

(6). TRIAS-JURA.

The retention of the above dual nomenclature at once indicates that we have not to any appreciable extent advanced our knowledge of the Mesozoic sedimentaries as developed in Tasmania. This is due to the fact that very little actual geological survey work has been attempted on our coal-fields. It is, however, very satisfactory to be able to announce that for the past ten months two geologists of the Geological Survey have been constantly employed on this work, and will be so occupied until the close of the summer, and our knowledge in this direction has already been extended. Mr. H. H. Scott is carrying out some work on the Trias-Jura flora which is being collected, and it is confidently hoped that within the next twelve months a somewhat comprehensive account of both the Permo-Carboniferous and Trias-Jura systems will be possible.

(7). TERTIARY.

Beyond the recognition at various localities of deposits of Tertiary age and the areal mapping of some of them, no advance has been made in working out the stratigraphy of Tertiary sediments, either lacustrine or marine.

IV. PALÆONTOLOGY.

(1). SILURIAN.

A valuable addition to our knowledge of Silurian fossil types was made as the result of the study by W. S. Dun of a suite of specimens collected by the Geological Survey. The resulting determinations are contained in Geological Survey Bulletin No. 8.

More recently, F. Chapman, A.L.S., has studied certain fossils from the Silurian limestone, and has prepared a description of the occurrence of Tetradium therein, which has been published as Geological Survey Record No. 5.

(2). Permo-Carboniferous.

As the result of the investigations carried out by the late W. H. Twelvetrees in the Mersey basin, our knowledge of the character of the organic component of the Tasmanite shale has been appreciably increased. In connection with the same examination also, W. S. Dun carried out some palæontological work on the Marine fauna of the Permo-Carboniferous beds in that area, and these are dealt with by that investigator in Geological Survey Record No. 1.

Apart from these increases to our knowledge there has been no advance in our Permo-Carboniferous palæontology.

(3). Trias-Jura.

No study similar to that carried out in recent years by Dr. Walkom in Queensland has been accomplished in Tasmania. The systematic geological survey of our coal-fields and other Trias-Jura areas now in progress is supplying material which promises to give important information. Mr. H. H. Scott is undertaking the palæontological work on these collections, and a contribution is anticipated which will mark a step forward in connection with this field of investigation.

(4). Tertiary.

A considerable amount of work was accomplished by the late Miss M. Lodder on the marine beds of Table Cape. An indefatigable collector in the same locality was the Reverend E. D. Atkinson, B.A.

A marsupial from this formation—*Wynyardia bassensis*, Spencer—is believed to link the Diprotodonts with the Polyprotodonts.

There has, however, during the period under review been no work whatever accomplished on our particularly rich Tertiary flora, and as far as can be seen at present there is no likelihood of any attention being paid to this most interesting field for research for some years to come.

(5). Pleistocene and Recent.

The Mowbray Swamp on the North-West Coast has supplied within the last ten years two most valuable and interesting skeletons of *Nototheria.* It is to the enthusiasm and

perseverance of Mr. H. H. Scott that we owe the excavation and preservation of these skeletons. To the same worker belongs the credit of first describing the *Nototherium tasmanicum*, which is accomplished at length in Geological Survey Record No. 4. The original skeleton has been mounted by Mr. Scott, and is now to be seen in the Victoria Museum, Launceston.

During the past year the second *Nototherium* was discovered, and this has been determined as *Nototherium mitchelli.* H. H. Scott and Clive Lord have already presented preliminary notes on this skeleton before the Royal Society of Tasmania, and a complete description, as well as the mounting of the specimen, is in progress.

The discovery of these two skeletons and their immediate study and description have effected a distinct advance of knowledge of the *Nototheria* in general.

Another important discovery of marsupial remains was made in King Island. The remains are fragmentary, but sufficient has been found to allow of the recognition by H. H. Scott of the giant kangaroo—*Palorchestes.* Further work remains to be carried out in this direction.

It is very evident from the above resumé of palæontological investigations that the Geological Survey itself has done very little in the palæontological branch of geology. This is only to be expected when it is remembered that the *raison d'etre* of the Geological Survey is the necessity of intensive study of our ore deposits, and the demand is for investigations having an obviously practical value. The significance of the role played by palæontology in all geological investigations is not realised by the great majority of mining men, and consequently the palæontological work essential to our studies in economic geology is carried out more or less surreptitiously, and, in the non-provision of a palæontologist on the staff, is mostly accomplished by taking advantage of the keenness and good nature of palæontologists belonging to other institutions and other States.

V. STRUCTURAL GEOLOGY.

Much light has been thrown on the tectonics of Tasmania during the period under review. The definite fixing of the stratigraphical succession has materially assisted in deciphering the structural geology of certain areas, and it is now possible to form a broad general conception of the tec-

tonics of the Island. Such generalisations must, however, be drawn with care in view of the relatively small areas in which structural geology has been investigated in detail.

The most recent summary of our tectonic geology is that included in Professor Sir T. W. Edgeworth David's Presidential Address to the Linnean Society in 1911. Since that date, however, considerable progress has been made towards supplying data for a more detailed general survey. The writer has dealt with this problem of the mapping of tectonic lines in connection with his work on the Metallogenic Epochs of Tasmania, and has summarised the conclusions which are justifiable on the evidence at present available.

It has been demonstrated that there have occurred in Tasmania at least three, and possibly four, distinct periods of orogenic movement, and one period of block faulting on a huge scale. To these diastrophic movements must be added the intrusion of the diabase, which, although unaccompanied by horizontal thrust, must on the evidence recently obtained by P. B. Nye in the Midlands have been characterised by vertical upthrusting on a very large scale.

The first definitely fixed orogenic period was that which followed the Pre-Cambrian sedimentation. If L. K. Ward's deductions in regard to the subdivision of the Pre-Cambrian are correct an earlier disturbance must be admitted. The direction of the tectonic lines of this Epi-Algonkian orogenic revolution swing in gentle curves from N.N.W. in the South, through N.N.E. near Cradle Mt., back to the N.N.W. to the Northwards, and ultimately end on the north coast with a N.N.E trend. The overfolding is towards the East. There was apparently no batholithic end-point to this Epi-Algonkian orogenic movement.

The period of sedimentation and contemporaneous effusive igneous activity which characterised the Cambro-Ordovician was followed by a pronounced orogenic revolution. The Epi-Cambro-Ordovician trend-lines are N.N.W. in the southern portion, bending to due N. in the neighbourhood of Rosebery, but resuming the general N.N.W. direction north of that locality. No overfolding has yet been observed. A batholithic end-point characterised the close of this orogenic period. The intense alteration and mineralogic reconstitution, which was characteristic of this orogenic movement, gave rise to the fissility of the Dundas slates and the schistosity of the Read-Rosebery and Mt. Lyell schists. The development of the schistose structure was

complete at the time the Epi-Cambro-Ordovician plutonics reached their *mise-en-place.*

The close of the Silurian period of sedimentation witnessed the geosynclinal collapse and the occurrence of the Epi-Silurian orogenic movements. The trend-lines are regularly directed N.N.W., and overfolding occurs both to the East and to the West, overthrusting having taken place on a considerable scale. The movements, although undoubtedly intense, did not produce the universal schistose structure which was the result of the preceding diastrophic period. The batholithic phase of this Epi-Silurian orogenic period was one of great importance and size, as it was responsible for the intrusion of our so-called Devonian granites, gabbros, and serpentines, together with their associated congeners.

Since the cessation of the Epi-Silurian orogenic movements there has been no recurrence of compressive forces in Tasmania. The vertical and upwardly directed thrusts of the diabasic invasions at the close of the Mesozoic era apparently gave rise to no horizontal thrusts. This conclusion seems inevitable as the result of the recent researches of P. B. Nye, and the evidence is to the effect that this diabasic upthrust carried upwards to varying heights isolated masses of Permo-Carboniferous and Trias-Jura sediments.

It has been long recognised that the present configuration of Tasmania is very largely due to the effect of tensional faulting on a large scale. During the period under review it cannot be claimed that this conception has been elaborated to any considerable degree. The contention advanced by E. C. Andrews and Dr. Griffith Taylor that the Midlands is a Rift Valley seems to have been disproved by P. B. Nye's recent investigations.

It is undoubtedly true, however, and a mass of confirmatory evidence relating thereto has been collected during the last 18 years, that block faulting has taken place parallel to the general trends of the coast-line. The basal beds of the Permo-Carboniferous system have, for example, been found at sea-level, and 3,000 feet above that level, and a great part of this is due to tensional block faulting, but the exact contribution to this difference of level by the upthrusting during the diabase injections has not been determined. Minor faults of this tensional series have been recognised, but it cannot be claimed that the major breaks have been accurately located. It is hoped that the work now in progress on our coal-fields will result in some valuable data in connection with this problem.

VI. PETROLOGY.

(1). PETROGRAPHY.

The knowledge gained during the period under review of the petrography of the igneous rocks of Tasmania has been considerable. This is not surprising when it is remembered that the late W. H. Twelvetrees was one of the most skilled petrographers of the Commonwealth, and the result of his 18 years' labour, combined with the work carried out by other officers of the Geological Survey, represents a distinct advance towards a complete description of our igneous rocks.

It may at the present time be confidently claimed that the petrographic descriptions of our Epi-Silurian plutonic acid and basic rocks by Twelvetrees, Ward, Waller, Waterhouse, McIntosh Reid, and Professor Benson represent an approach to a complete knowledge of the character of the numerous rock-types of this series.

Similarly it is justifiable to claim that the descriptions of the composition and microscopic structure of the diabase which constitutes such a great proportion of Tasmania, presented at various intervals by Twelvetrees, Petterd, Ward, Professor Benson, A. Osann (Frieberg), and F. P. Paul, constitute an almost complete demonstration of the petrography of this rock.

Completeness in petrographic descriptions also characterises the investigations of our Tertiary basalts, whether they be the normal olivine basalts, the limburgite, or the trachydolerite of Table Cape and Stanley. It is to Twelvetrees, Petterd, and Ward that we owe our detailed knowledge of these.

Although considerable advance has been made in deciphering the variations in rock-types in the Port Cygnet alkaline series and the probably comagmatic nepheline basalts of Bothwell, and the melilite basalt of Sandy Bay—work in which Twelvetrees, F. P. Paul, and Professor Benson have been most prominent—yet there remains a very large amount of investigating to be done before anything approaching the detailed character of our knowledge in regard to the Epi-Silurian plutonics is attained. It is in such a case as this that there is severely felt the handicap to progress which is occasioned by the elimination of the subject of geology from the University curriculum, as the Port Cygnet alkaline series, by reason of both their interest and

their proximity to Hobart, must inevitably appeal as a subject of research to an active School of Geology located at Hobart. The most complete description of this series so far published is that by Dr. F. P. Paul, which appeared in 1906. (1)

There now remains to be discussed the advance in knowledge of the Porphyroid Igneous Complex during the last 18 years. The work accomplished in this field is considerable, as is evident when it is remembered that it is during this period that the conception of this Porphyroid Igneous Complex as a distinct igneous rock series has been gradually evolved. The petrographic studies carried out on the innumerable varieties of quartz-porphyries, felspar-porphyries, felsites, syenites, granites, etc., occurring in close association on the West Coast have resulted in a gradual separation of a very large group of these igneous rocks which are characterised by mineralogic reconstitution and evidence of great physical strain, from a group relatively less plentiful in varieties which possess no internal evidence of such dynamic metamorphic action. To the former group the name "porphyroid" was applied by G. A. Waller in 1902, and subsequently this term was adopted as a group name as the result of considerable study by the late Professor H. Rosenbusch, to whom recognition must here be made of very great assistance in elucidating the petrography of this group of igneous rocks.

It is a very difficult task, in view of the mineralogic reconstitution and mechanical deformation which this series of rocks has undergone, to recognise the original character of the several rock-types from petrographic study. Gradual progress in description and in deductions as to original character has been made, mainly by Twelvetrees, Ward, Professor W. Gregory, and the writer, and it is now perfectly clear that in this Porphyroid Igneous Complex we have a comagmatic series consisting of effusive, intrusive, and plutonic types ranging in composition from basic to acid. There still remains, however, a great amount of work to be done in the petrographic study of an almost unlimited number of varieties of this series particularly in the case of the effusive and fragmental types, and also in connection with the basic plutonics.

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(1) F. P. Paul: "Beitrage zur petrographischen Kenntniss einiger foyaitisch thiralitischen Gesteine aus Tasmanien" Mineral. petr. Mitteil Band 25, Heff IV., Wien, 1906.

(2). PETROGENESIS.

Viewing the igneous rocks of Tasmania from the broader standpoint of petrology and accepting the most comprehensive significance of that word, the questions of chemical composition, structure of the igneous masses, and mode of origin come up for consideration and investigation.

In regard to chemical composition it must be at once admitted that our progress has been practically nil. The number of rock analyses carried out during the last 18 years is practically negligible. It was hoped when the Geological Survey Laboratory was established in 1914 that rock analyses would be systematically carried out if only slowly, but it has been found impossible up to date, owing to the time taken in routine assay work, to devote any time to rock analysis. It is hoped, however, that the conditions will be improved in the near future. The serious hindrance to progress that this lack of rock analyses imposes is so obvious that no further comment is needed.

The petrogenic problems in Tasmania are decidedly complex, and it cannot be said that any near approach has been made to their solution. It can, however, be claimed that some progress has been made.

In regard to the question of geologic age it cannot be more definitely stated of the Porphyroid Igneous Complex than that it belongs to the Cambro-Ordovician. Some of the effusive and fragmental members of that complex are contemporaneous with the larger sedimentary series of that system, while others undoubtedly succeeded the main sedimentation. On the whole the evidence points to the fact that the greater part of the igneous series belong to the closing phases of the Cambro-Ordovician, although this has by no means been completely demonstrated. It is clear, however, that the acid plutonic members represent the end-point of the Epi-Cambro-Ordovician orogenic disturbance, as these show much less crushing than the other members of the complex.

It has been demonstrated by Ward, and confirmed by Waterhouse and McIntosh Reid, although originally suggested by Waller, that the basic and ultra-basic members of the Epi-Silurian igneous series are slightly older than the acid and sub-acid members—in other words, that the basic portion of the magma appeared at the beginning of the petrogenic cycle, while the acid portion followed shortly afterwards. As previously pointed out in this review, this pet-

rogenic period occurred at the close of the Epi-Silurian orogenic paroxysm.

No more definite determination of the Diabase has been made than that it is Post-Trias-Jura and Pre-Tertiary. It is generally referred to the Cretaceous, but there has been no further evidence of this adduced since the late W. H. Twelvetrees wrote his summary in 1902.

An important discovery was made by Professor E. W. Skeats in 1916 when he located a dyke of the Port Cygnet Alkaline Series cutting the diabase near Woodbridge. In a paper read before the Royal Society of Victoria (2) Professor Skeats discusses this discovery and demonstrates the Tertiary age of this most interesting alkaline series. Up to the time of this discovery the series was regarded as of Permo-Carboniferous age.

No data whatever have been obtained from which to determine the relative ages of our olivine basalts, limburgite, trachydolerite, and melilite basalt. We know that they are Tertiary, but our knowledge has not advanced in this direction during the period under review.

In only one district have sufficient investigations of the structural features of the Porphyroid Igneous Complex been carried out to enable definite conclusions to be drawn in regard to the actual structure of the masses of various rock-types of the series. The area referred to is the Read-Rosebery district, in which the writer has mapped the fold axes of the Cambro-Ordovician sediments and the associated igneous rocks, and demonstrated that the felsite or keratophyre which is so well developed in that locality is in the form of an extrusive sheet now characterised by a complex series of folds. Evidence gathered at other localities on the West Coast gives confirmation of this effusive character of many of the porphyries, porphyrites, spilites, etc., but the mapping of the structural geology has not advanced far enough to allow of the definite demonstration of the structure as that of contemporaneous extrusive sheets in the same detail as in the Read-Rosebery district. Neither is it yet possible to give any indication of the order of succession within this petrogenic cycle—an achievement which will only be possible when the structural features of the whole Cambro-Ordovician system have been elucidated.

As indicated above the end-point of the Cambro-Ordovician petrogenic cycle, as well as that of the Epi-Cambro-

(2) Proc. Roy. Soc. Vic., Vol. XXIX., Part II. (1917), pp. 155-164.

Ordovician orogenic period, was the intrusion of the granite. This granite has been recognised at four localities:—South Darwin, Dove River, Mount Farrell, and Bond's Peak. At the two former localities it is clearly intrusive into other members of the complex, but in the vicinity of Mount Farrell there is a mergence by insensible gradations into members which are clearly extrusive. This very puzzling structure is being dealt with by the writer in his work on the "Metallogenic Epochs of Tasmania," and it seems probable that we have here a possible illustration of "extrusion by de-roofing," as propounded by R. A. Daly. If this is so, however, the granitic phase of the batholithic period is not confined to the end-point alone.

Apart from the areal mapping of the basic and acid members of the Epi-Silurian petrogenic period there has been very little progress, with one noticeable exception, towards arriving at general conclusions in regard to the structure and relationships of the various igneous massifs. The exception referred to is the paper read before this Association in 1911 by L. Keith Ward, entitled "The Heemskirk "Massif—its Structure and Relationships." In that paper the conception is developed that the Heemskirk Massif possesses a definite bottom and is chonolithic in character rather than laccolithic or batholithic. Ward further proceeds to hypothecise two parallel lines of crustal weakness along which igneous intrusion has taken place, and maintains that the various Epi-Silurian igneous massifs, although possibly connected in depth along these lines, are elsewhere quite separate intrusive bodies. Work carried out since the preparation of that paper, however, throws serious doubt on the accuracy of these conclusions. A great difficulty in regard to the acceptance of the existence of the Bischoff and Heemskirk-Middlesex lines of crustal weakness which have been the loci of igneous intrusion lies in the significant fact of the concordance between the orientation of the major axes of the igneous massifs and the Epi-Silurian fold axes. As stated above, the Epi-Silurian trend lines have a bearing of N.N.W.—a direction which is at right angles to that of the two lines indicated by L. K. Ward. Add to this the irregular but wide distribution of the outcrops of both basic and acid massifs of this series, which is obvious from a glance at the Geological Map of Tasmania, and the difficulty of accepting Ward's conclusions is apparent.

The evidence seems to point to the conclusion that the Epi-Silurian magma reached its final resting place in the

form of a limited number of composite batholiths. It, moreover, seems possible that there finally resulted one huge batholith underlying the greater part of Tasmania, the cupolas and satellitic injections from which now represent the apparently isolated massifs as we at present see them.

In spite of the great amount of work that has been accomplished, and the numerous descriptions written in regard to the petrography of the Tasmanian diabase, yet, as pointed out by Osann, there is very little in existence descriptive of its field occurrence and structural relationships. We know that it is intrusive and that undoubted sills and dykes occur, and this was the state of our knowledge in 1902 with the addition that other masses had had a laccolithic structure suggested for them. It is therefore disappointing to have to announce that up to the beginning of the past year no material advance had been made in this connection. Certainly L. K. Ward recognised two distinct horizons of intrusive sheets near the King William Range, but no work was done on the larger diabase massifs to elucidate their morphology and mode of origin. During the past year, however, the geological surveys carried out in the Midlands by P. B. Nye, on the East Coast by H. G. W. Keid, and during the last few months by A. McIntosh Reid, have supplied valuable data which, along with that being acquired at the present time in the extensions of those surveys, will probably enable a very complete summary of the field occurrence of our diabase to be prepared. The evidence so far obtained points to our larger diabase massifs being asymmetric laccolithic intrusions possessing an almost vertical face on one or more sides, but grading off into an intrusive sheet on one or more of the others.

Very little work has been done on the field occurrences of the Cygnet Alkaline series and the probably associated nepheline and melilite basalts, and the status of our knowledge in this connection is practically as it was in 1902.

Beyond the areal mapping of some of our olivine basalt areas no advance has been made as to the mode of origin. Certainly the negative evidence provided by the failure to locate a single volcanic cone is valuable but not conclusive evidence of fissure eruptions.

This short review of the progress in petrologic science cannot be complete without a reference to that most interesting discovery—the Darwin Glass. The credit of first bringing this substance under the notice of the Geological Survey belongs to Hartwell Conder, M.A., who in 1912, while acting

as State Mining Engineer, had several fragments presented to him by one of his prospectors. These fragments were reported to have been derived from the Western portion of the Jukes-Darwin area, and the assignment of the writer to carry out a geological survey of that area early in 1913 gave an excellent opportunity for a detailed investigation of the occurrence. The results of such investigation are presented in Record No. 3 of the Geological Survey, and the conclusion there indicated that this substance is of cosmic origin and belongs to the Tektites, being most nearly allied to the Moldavites, but differing from the latter in the remarkably high silica content (89 per cent.). Since the publication of that official description Dr. H. S. Summers has discussed the composition in relation to the other members of the Tektites, and Dr. F. Suess, of Vienna, the world's authority on this subject, has fully discussed this substance and its bearing on the whole problem of the Tektites in a paper entitled "Ruckshau und Veneres uber die Tektitfrage." (3)

The writer would, however, here enter an objection to the name proposed by Suess, namely, "Queenstownite," on the grounds that the Darwin Glass does not occur at Queenstown, the nearest occurrence being ten miles from that town.

VII. MINERALOGY.

Considerable advance has been made in this branch of geologic science during the period under review. Most of the increase in knowledge has been gained during the petrographic researches indicated in the preceding chapter, and also incidentally to the intensive study of our ore-deposits, which will be dealt with in the chapter following this.

It is to the late W. F. Petterd that the greatest amount of credit must be given for our advance in our knowledge of the minerals of Tasmania. The "Catalogue of the Miner-"als of Tasmania," published by that enthusiastic mineralogist in 1896, was a valuable contribution, and served as the standard reference on Tasmanian Mineralogy until 1910, by which time the increased information acquired necessitated its re-writing, which was completed early in that year and published under the authority of the Mines Department. The advance made in that period is well indicated by the fact that this second edition contains descriptions of over one hundred more mineral species than the first compilation.

(3) Mitteil der Geol. Sesell. Wien. I., ii., 1914.

The State of Tasmania is further indebted to this investigator by reason of the bequests made by him to the Royal Society of Tasmania of his valuable collection of minerals. This collection, which is the best collection of Tasmanian minerals in existence, and in many particulars quite unique, is now to be seen in the Tasmanian Museum, Hobart.

In addition to this publication, which deals specifically with the subject of mineralogy, there has appeared a wealth of detail as to varieties and some new species in the various publications of the Geological Survey of Tasmania. In regard to one mineral species a special publication was issued as Geological Survey Record No. 2, entitled "Stichtite— "a New Tasmanian Mineral."

An interesting and important discovery was that made by the Geological Survey in 1913 of the occurrence of osmiridium in the parent serpentine rock. Since that date the two varieties of that mineral have been definitely determined— siserskite and nevyanskite. Some very valuable work has recently been carried out by A. McIntosh Reid and W. D. Reid, of the Geological Survey Staff, on the composition of osmiridium and several minerals of the platinum group, including one probably new species.

The most valuable contributions by the Geological Survey since the last edition of the "Catalogue of the Minerals "of Tasmania" in 1910 are those dealing with the paragenesis of the mineral components of our ore deposits rather than with the identification of new species. This type of investigation is in accordance with the recent development of the subject of mineralography, and the application of the latest methods of investigation has already thrown much light on the inter-relationships of the component minerals of our ore-bodies, and promises to be of even greater utility in the near future. The studies made by L. L. Waterhouse of the contact metamorphic deposits of Stanley River and Heemskirk are valuable contributions to our knowledge of the mineral paragenesis of this type of ore deposit. The complete paragenesis of the complex zinc-lead sulphide ore deposits of Read-Rosebery has been demonstrated by the writer, who is at present engaged on similar investigations in connection with the geological survey of the Mount Lyell field. In this connection it must be noted that Gilbert and Pogue, of the American National Museum, have carried out a mineralographic study of some of the ore of the Mount Lyell field forwarded to them by Mr. R. C. Sticht.

VIII. ORE-DEPOSITS.

(1.) THE DEVELOPMENT OF THE INVESTIGATIONS.

It is in this domain that our greatest advance has been made. This is not surprising, in view of the fact that the study of our deposits of economic minerals is the *raison d'etre* of the Geological Survey.

The earlier portion of the period under review witnessed intense mining activity in Tasmania, and it is to the developments resulting from such work, together with the concurrent demand for geological examinations, that we owe the opportunities for research which have been productive of appreciable results.

The year 1902 saw the late W. H. Twelvetrees and his assistant, G. A. Waller, busily engaged examining active mining fields and preparing incomplete geological maps of those areas. The work performed by Waller in the Zeehan field constitutes the first complete geological mapping of a mining field executed in Tasmania. There was gradually evolved at this period by both investigators the conception of a genetic connection between the plutonic igneous rocks and our ore-deposits, particularly between the granitic rocks and our tin, lead, zinc, and iron deposits.

After the resignation of Waller in 1904 the late W. H. Twelvetrees continued the examination of ore deposits, without, however, having the opportunity of carrying out detailed mapping. With the appointment in 1907, however, of L. Keith Ward as Assistant Government Geologist, an opportunity was afforded of initiating systematic studies of our ore-deposits, accompanied by the detailed geological research which is essential to an understanding of their genesis. The old ground traversed by Twelvetrees and Waller was retraced and new ground broken as opportunity offered, and these repeated examinations of our more important mining fields and their ore-deposits have continued up to the present time, with the result that the knowledge we now possess of these ore-deposits is considerable.

(2). THE GALENA LODES OF ZEEHAN.

The earlier investigations by G. A. Waller on the ore deposits of the Zeehan field were elaborated in detail by Twelvetrees and Ward, and the composition, structural features, and genesis thoroughly elucidated. The galena-bearing lodes are grouped into two belts—the Pyritic Belt and the Sideritic Belt. The difference in mineralogic composition

has been determined by zonal precipitation, each zone representing certain limiting ranges of temperature and pressure which characterised the conditions during actual deposition of the mineral species from the ore-bearing solutions. The origin of the ore-bearing solutions is ascribed to the differentiating igneous mass which gave rise to both them and the underlying granitic mass.

L. K. Ward elaborated this conception of zonal precipitation in a paper read before this Association in 1911, entitled "An Investigation of the Relationship between the Ore-"bodies of the Heemskirk-Comstock-Zeehan Region and the "Associated Igneous Rocks." His conception demonstrates three zones—the Granite Zone; the Contact Metamorphic Zone; and the Transmetamorphic Zone—the latter being subdivided into the Pyritic and Sideritic Belts. The factor determinating the amount and kind of precipitation from the outwardly migrating ore-bearing solutions is the decrease in temperature and pressure as distance is gained from the magmatic hearth.

It must be here pointed out, however, that A. McIntosh Reid has recently adduced evidence which shows that the Comstock magnetite deposits, classed as contact-metamorphic by Ward, are magmatic differentiations within the basic phase of the Epi-Silurian plutonic period. There are, however, undoubted contact metamorphic magnetite and hæmatite deposits around the periphery of the granite, and Ward's conception of zonal distribution is not affected in general principle.

(3) The Read-Rosebery Zinc-Lead Sulphide Deposits.

These deposits have been studied in detail by the writer, and their composition, structural features, mineralogy, and genesis are fully delineated in Bulletins 19 and 23 of the Geological Survey. The northern extension of this belt is described by A. McIntosh Reid in Geological Survey Bulletin No. 28.

It is shown that the zinc-lead sulphide ore-bodies are metasomatic replacements of schistose calcareous beds in the Read-Rosebery schist series, which, as previously indicated in this review, are predominantly sedimentary in origin. The component beds of this schist series have been thrown into a series of complex folds by the same stress which brought about their schistosity. The axes of the two series of folds are at right angles to each other, and the more important of these have been mapped. The actual structure observable

is that of a series of irregular domes and basins, so that at any mine level the outline of the ore-bodies is irregularly lenticular.

The origin of the ore-bodies is ascribed to ascending magmatic waters genetically associated with the Epi-Silurian quartz-porphyry and granite-porphyry dykes in the vicinity.

(4). The Tin Deposits of North-East Dundas.

These were examined in detail by L. K. Ward in 1908, and their structural features, composition, and genesis are described in Bulletin No. 6 of the Geological Survey. Some of the later developments in the various mines are dealt with by Hartwell Conder, M.A., in Bulletin No. 26.

The tin deposits are grouped by Ward under two heads—Pyritic-Cassiterite deposits and Quartz-Tourmaline-Cassiterite Veins. The composition and structural features have been somewhat completely elucidated, and the genesis referred to the associated granite-porphyry and quartz-porphyry dykes of Epi-Silurian age. However, it cannot be stated that the exact relationship to the pyritic-lead deposits, the garnet actinolite veins or the axinite veins, which occur associated with the tin-deposits, has been demonstrated. Neither can it be claimed that the mineralography of the pyritic-cassiterite ores has been closely studied, especially in regard to those of dense stanniferous pyrrhotite.

(5). The Ore Deposits of the Mount Farrell District.

The investigation carried out by Ward in 1907 on the ore-deposits of this district was an elaboration of previous examinations by Twelvetrees and Waller.

Ward's description of these deposits, contained in Geological Survey Bulletin No. 3, shows three types of lead deposits—Sideritic-Galena lodes, Pyritic-Galena lodes, and Barytic-Galena lodes. No attempt, however, is made at a zonal classification similar to that evolved for the Zeehan field.

Certain types of copper ores, as well as iron ores, are described, and the genesis of all of the ore deposits is ascribed to the Epi-Silurian plutonic period. However, the relationship between the lead-deposits, those containing copper, and the hæmatite and magnetite deposits is not elucidated, so that a common genetic origin for them all is by no means certain.

(6). THE TIN DEPOSITS OF THE STANLEY RIVER DISTRICT.

These have been described in detail by L. L. Waterhouse in Bulletin 15 of the Geological Survey, following upon previous work by G. A. Waller.

The deposits are mainly of the Quartz-Tourmaline-Cassiterite type and what are termed Stanniferous Contact Metamorphic Deposits. These are both described in detail in regard to structural features, composition, and paragenesis. It is important to note that it has been demonstrated by Waterhouse that the cassiterite in the contact metamorphic deposits is later than the contact metamorphic minerals. The origin of the ore-bearing solutions is shown to be the Epi-Silurian granitic plutonics strongly developed in the field.

Sufficient evidence, however, is not available to establish the definite relation between the two types of tin deposits, nor between these and the zinc and lead veins.

(7). THE HEEMSKIRK TIN DEPOSITS.

G. A. Waller described these deposits in considerable detail in 1902, and L. L. Waterhouse carried out a more comprehensive survey in 1914. The description of this field is contained in Bulletin No. 21 of the Geological Survey, and the description of the ore deposits is presented in meticulous detail.

The tin deposits are classified into six types:—

(1) Quartz-Tourmaline-Cassiterite Veins;

(2) Quartz-Quartzose Deposits;

(3) Pyritic Cassiterite Deposits;

(4) Pinitoid Veins;

(5) Greisen Veins;

(6) Pipe Formations.

The structural features, composition, and paragenesis of all of these types are described in detail. In addition, contact metamorphic deposits are described, as well as zinc and lead deposits and nickel ores. It is shown that certain of the zinc and lead deposits are variants of certain of the tin veins, and zonal precipitation is given as the explanation of the change in character with increasing distance from the magmatic hearth. The contact metamorphic deposits preceded the tin deposition.

The whole of the ore deposits in the field are shown to be genetically connected with the Epi-Silurian plutonics.

(8). The Ore Deposits of Mount Balfour.

These were examined by L. K. Ward, and described in Geological Survey Bulletin No. 10.

Two groups of deposits are shown to exist—the Copper Group and the Tin-Tungsten Group. Both are described, and a zonal distribution in relation to a hypothetical granite core to the Balfour Range is suggested, although not definitely established. However, it is assumed that they are both genetically connected with the Epi-Silurian granite of the district, although the evidence for the copper deposits is by no means conclusive.

(9). The Ore Deposits of Jukes-Darwin.

Following upon the work carried out by the late W. H. Twelvetrees twelve years before, the writer in 1913 made a thorough investigation of the ore deposits of this region. The results of this investigation are contained in Geological Survey Bulletin No. 16.

The ore deposits are classified into the following groups:—

(1) Copper-Silver-Gold Ore-bodies;

(2) Hæmatite and Magnetite Deposits;

(3) Blue Hæmatite-Bornite Veins;

(4) Barytes Lodes;

(5) Quartz Lodes;

(6) Epidote Veins.

The composition, structural features, and paragenesis of these deposits are described. It is shown that the hæmatite and magnetite ore-bodies are genetically connected with the granite of the porphyroid igneous complex. The problem of metallogenesis is discussed at some length, but the evidence was at that time not found sufficient to justify definite conclusions as to which metallogenic epoch or epochs the remaining groups were to be assigned.

(10). The Ore Deposits of the Middlesex-Pelion Area.

These have been described in successively greater detail by G. A. Waller, the late W. H. Twelvetrees, and A. McIntosh Reid.

The late W. H. Twelvetrees was the first to recognise the true nature and origin of the garnet rock which forms the country rock of the tin-wolfram-bismuth lodes of the S.

& M. Mine, Moina. The description of this rock and the structure, composition, and paragenesis of the lodes are presented in Geological Survey Bulletin No. 12. The origin is assigned to the adjacent Epi-Silurian granite, which gave rise to the garnet-magnetite rock as a contact metamorphic rock as a metallogenic phase preceding the tin-wolfram-bismuth phase.

The galena ore-bodies at Round Hill are also assigned to the same source as their origin, and are shown to have a saddle structure similar to the Bendigo saddles. They are assigned to an outer zone of the tin phase of the Epi-Silurian metallogenic epoch.

A. McIntosh Reid has described in Bulletin No. 30 the wolfram and copper deposits of the Pelion District. In the relatively undeveloped state of these deposits complete descriptions are not possible. The genesis of the wolfram is definitely assigned to the Epi-Silurian granite, but the evidence for the age determination of the copper deposits is not as conclusive.

(11). The Ore Deposits of Scamander.

These are described by the late W. H. Twelvetrees in Bulletin No. 9 of the Geological Survey. The structural features and composition are described, and they are grouped as follows:—

(1) Wolframite and Cassiterite Veins;

(2) Arsenopyrite-quartz-chalcopyrite lodes;

(3) Arsenopyrite-quartz-argentiferous lodes.

The distribution of these groups is interpreted as indicating a zonal precipitation outwards from the Epi-Silurian magmatic hearth in the order indicated above.

(12). The Osmiridium Deposits.

The occurrence of osmiridium in alluvial deposits has been known for many years, and its origin from serpentine was regarded as almost proved, but it was not until the year 1913 that this mineral was definitely established as being an original component of the serpentine rock. In that year the discovery of what were termed "osmiridium lodes" was responsible for the examination of the Bald Hill area by the late W. H. Twelvetrees, and as a result of this investigation the occurrence of osmiridium as a constituent of serpentine was definitely established. This is described in Geological Survey Bulletin No. 17.

During the summer of 1919-20 A. McIntosh Reid carried out a very thorough investigation of the occurrences of osmiridium in Tasmania, and his bulletin dealing with the questions of composition, mode of occurrence, and genesis is now in the Press. In this bulletin the differentiation of the basic phase of the Epi-Silurian plutonic period is studied in detail, and it is shown that the osmiridium is confined to the ultra-basic olivine-rich differentiates now converted to serpentine. It is further shown that the distribution within the serpentine masses is controlled by the occurrence of definite contraction fissures.

(13) Ore Deposits of Various Districts.

In addition to the ore deposits in the districts mentioned above which have been investigated in detail, there are a very large number of isolated deposits which have been subjected to more or less complete examinations without completely elucidating their relation to the general geology. It may in fact be claimed that we possess a good general knowledge of the mineralogic composition of the great majority of the ore-deposits of Tasmania. It cannot, however, be claimed with equal justification that either the structural features, paragenesis, or genesis of the deposits, other than those specifically mentioned above, have yet been completely elucidated and described. It is certainly a fact, however, that sufficient material is available, either published or unpublished, to enable such an elucidation and demonstration to be effected, and the writer is attempting this undertaking in his work on "The Metallogenic Epochs of Tasmania."

(14). Metallogenic Epochs.

It was recognised by the late W. H. Twelvetrees in 1909 that there have been at least two metallogenic epochs—one genetically associated with the porphyroid petrogenic cycle, the other with the Epi-Silurian batholithic epoch. Since that date additional material for the genetic classification of our ore-deposits has been acquired, and the writer is presenting such a complete genetic classification in his above-mentioned work, in addition to demonstrating the various phases and zones of the several metallogenic epochs.

IX. SOME PROBLEMS AWAITING SOLUTION.

(1). Areal Mapping.

The total area of Tasmania is 26,215 square miles. The areas of which geological maps have been made as the re-

sult of definite surveys measure in all 2,122 square miles. There, therefore, remain to be mapped 24,093 square miles. This, it must be admitted, is a big task.

In addition, it must be pointed out that the greater part of those geological maps already prepared are approximate only, and the more accurate survey of these areas is a problem for the future.

(2). PHYSIOGRAPHY.

(a). A more detailed description than anything attempted heretofore of the topographic features of Tasmania is a desideratum. A large amount of field work yet remains to be done before such an account can be completed. Particularly does this apply to the south-western portion of the Island.

(b). The exact relationship between the more prominent topographic features and geolcgic structure must be worked out. Particularly does this apply to the problem of the respective roles played by the diabasic upthrust, Tertiary tensional faulting, and erosion in the evolution of our Diabase Highlands. A similar problem confronts us in the origin of those "inland seas," Macquarie Harbour and Port Davey, as well as the D'Entrecasteaux Channel and the Derwent Estuary.

(c) Some of our highland lakes are of glacial origin, but the problem of the origin of the greater number of our lakes is still to be solved.

(d). The evolution of the drainage system of Tasmania has yet to be traced. Incidental to this is the problem pointed out by Dr. Griffith Taylor, in his "Australian Environ-"ment," of the pronounced bends in some of our largest rivers.

(e). The exact limits of the Darwin peneplain have yet to be determined. Does it extend to the North-East and East Coasts? What is its relation to the Tertiary tensional faulting?

(3). GENERAL GEOLOGY.

(a). The stratigraphy and structural geology of the old sedimentary system at present termed Pre-Cambrian yet remain uninvestigated in detail. This is undoubtedly an undertaking of considerable magnitude, necessitating, as it obviously will, explorations in uninhabited and heavily timbered and mountainous country. Correlation of this rock

system with the Pre-Cambrians of the Australian mainland is a step which can only follow such an investigation.

(b). The relationship of the Dikelocephalus sandstone series to the other rock systems still remains to be determined. It seems highly desirable that the series should be thoroughly searched for a complete suite of fossils, and these examined in detail in order to definitely establish, or otherwise, the Cambrian age determination.

(c). The rock system now termed Cambro-Ordovician requires more exact age determination. Particularly should search be directed in the sedimentary members for fossils which so far have escaped observation.

(d). The stratigraphic relationship between the Dundas slates, the Balfour slates and sandstones, and the Mathinna slates and sandstones yet remains to be determined.

(e). The structural geology of the whole of the Cambro-Ordovician system must be worked out on the lines already accomplished in the Read-Rosebery district. In this connection it will be important to deduce from the strike and dip of the planes of schistosity of the schistose members of this system the position of the drag folds, and from these to determine the location of the axes and dimensions of the major folds.

(f). The petrology of the porphyroid igneous complex must be studied in greater detail, and the effusive and pyroclastic members distinguished from the intrusive and plutonic. With the solution of the structural problem will then come the opportunity of finally determining the order of succession within the petrogenic cycle. Incidental to this is the relationship between the Read-Rosebery and Mt. Lyell schists, which are probably different facies of the same geologic horizon.

(g). The sapropelic coals of the Permo-Carboniferous system are deserving of minute investigation, as they promise to throw much light on the natural history of coal. The exact details of the transition from these coal beds to the Tasmanite shale marine facies of the same horizon still remain to be determined.

(h). The stratigraphy and more definite age determination of our Trias-Jura system both demand attention. Particularly a detailed study of our Trias-Jura flora and comparison with that of the mainland must be undertaken. It is important also to determine whether the break between

the Permo-Carboniferous and Trias-Jura is an unconformity or a disconformity, or whether there is a conformable succession.

(i). The study of the stratigraphy and the abundant flora of our lacustrine Tertiary beds is a desirable and attractive undertaking, and it is surprising that this has not been attempted in view of the very strong development of these beds at our second largest centre of population.

(j). The detailed mapping of the glaciated areas of Tasmania is a task yet before us, although some progress has been made. The location of the ice-sheets and the glaciers descending therefrom has only been partially effected, but the final solution of this problem necessitates work in some of the wildest and most inhospitable parts of the Island.

(k). The details of the separation of Tasmania from the Mainland have yet to be determined.

(l). The mapping of the Port Cygnet alkaline series has not yet been accomplished, and the order of succession within this petrogenic cycle yet remains to be determined.

(m). The study of the field occurrence of the diabase so long neglected has only recently been undertaken, but as this rock covers such a large proportion of Tasmania the amount of work to be accomplished on this problem is very considerable.

(n). The investigation of the structural relationships of our Epi-Silurian plutonics is an important one, and still remains to be satisfactorily dealt with.

(o). The determination of the exact relationship between our trachydolerites, limburgites, and normal olivine basalts.

(4.) ECONOMIC GEOLOGY.

(a). The detailed description of some of our most important ore deposits yet remains to be accomplished. This applies particularly to the copper deposits of Mt. Lyell, the tin deposits of Mt. Bischoff, and the galena lodes of the Magnet district.

(b). The mapping and description of the ore deposits of various types in many districts not yet examined in detail represent work for some years to come.

(c) The genetic classification of those of our ore deposits which have been examined to any appreciable extent

is very desirable. This must entail the recognition of the metallogenic epochs, and in addition the greater refinement of the various phases within each epoch. This is the problem on which the writer has been engaged in preparing his thesis on the "Metallogenic Epochs of Tasmania."

(d) Much work remains to be done on the determination of the extent and value of our coalfields.

(e). No work of importance has been attempted in regard to our building stones. This is a subject for valuable study.

(f). The investigation of our deposits of the raw materials in the ceramic and glass-making industries is badly needed.

(g). An important mineralographic study awaiting attention is that of the stanniferous pyrrhotite ore-bodies of North Dundas. The determination of the mode of occurrence of the tin and its exact relationship to the pyrrhotite is an important preliminary in any metallurgical research on these ores.

(h). The whole problem of the genesis of our ore deposits and the factors controlling their deposition fairly bristles with intricate problems which are too numerous to attempt to indicate in this paper. Suffice it here to say that the progress already made is only a very small portion of the work necessary before anything approaching a complete elucidation of the factors controlling the distribution, extent, and value of our valuable mineral deposits can be attained.

(5.) Correlation.

With the exception of that accomplished in regard to the Permo-Carboniferous and Trias-Jura systems, practically no work has been done on correlating our Tasmanian systems and rock species with those of the mainland. This is important work which will only become possible of complete accomplishment as our investigations extend in Tasmania. Much, however, can be done at present, and it is very desirable that the first opportunity should be seized of summarising the conclusions which are possible on present evidence.

FRANCE AND AUSTRALIA.

THE "PRISE DE POSSESSION."

A NEW CHAPTER IN OUR EARLY HISTORY.

BY THOMAS DUNBABIN, B.A. (Oxon.), M.A. (Tasmania).

[Originally written for the Hobart-Melbourne Meeting of the Australasian Association for the Advancement of Science, January, 1921.]*

(Read before the Royal Society of Tasmania, 8th August, 1921.)

When Ernest Scott, Professor of History in the University of Melbourne, was working on his *Life of Flinders*, he employed a copyist to obtain material from the Paris archives. The copyist found so much about Australia that the charges mounted very high. So Professor Scott pointed out to the Commonwealth Parliamentary Library and the Mitchell Library that they ought to have copies of these valuable historical documents. The authorities agreed, and the cost of Professor Scott's material was one-third of what it would otherwise have been.

This partial overhaul of the Paris archives by an intelligent copyist has thrown a flood of light on the early relations of France and Australia. An examination of the papers in the Commonwealth Library, made by the courtesy of the Speaker, reveals the hitherto unpublished fact that a French expedition did, in 1772, take formal possession of Western Australia.

It is not in France alone that material may be found. Hidden away in some dusty corner in Portugal, Spain, or possibly Holland, there may be documents which upset accepted ideas about the obscure but fascinating subject of early exploration in Australasian regions. For the history

*Owing to the Shipping Strike, the Meeting of the A.A.A.S., which was to have been held in Hobart in January, had to be held in Melbourne. Many difficulties had to be overcome, and it was found impossible to publish the usual full report of the A.A.A.S. Meeting and to print all papers. Arrangements were therefore made for certain papers to be read before the Society and published in the Papers and Proceedings for 1921.

of the early days of settlement, too, there may be valuable material awaiting research. American vessels played a great part in the early trade of Australasia, and in the whaling and sealing which were the greatest industries of those days. In the twenty years from 1792 to 1812 over fifty American vessels called at Sydney, while many others visited Australasian waters without going to Sydney. There may be much of Australian interest in the ships' logs and other records of the old New England whaling towns. Even Russia is not too far afield to have possibilities. Several Russian expeditions visited Australia in the early days, including that of Bellingshausen, one of the greatest of Antarctic explorers, who paid two visits to Sydney in 1820.

THE FEAR OF FRANCE.

France might have been a serious rival for the possession of Australia. To a large extent the early history of Australia was shaped by the fear of French rivalry. This fear caused the founding of the first settlements in Tasmania, in Western Australia, and in tropical Australia. It led to the sending of Collins' Expedition to Port Phillip in 1803, and to the temporary settlement of Westernport in 1826.

French interest in the South Seas goes back to a date nearly a century before the first British Settlement. From 1699 onwards projects for exploration and colonisation in the far South were continually being put forward in France. Two years after Cook had taken formal possession of the Eastern part of Australia for Great Britain a similar ceremony was carried out on the Western Coast on behalf of France.

DE VOUTRON'S VOYAGE OF 1687.

Just as the voyage of Cook was but the greatest of a series of English voyages to the South Seas of which the earlier ones are now almost forgotten, so French interests in the New World of the South by no means began with Marion's voyage of 1772. Take, for instance, the letter which de Voutron, a French sea captain, wrote to the Minister for Marine from La Rochelle on February 10, 1699. In this he offers to lead an expedition to explore, with a view to colonisation, that part of the Terres Australes called by the Dutch New Holland. He states that he and his brother-in-law, Duquesne, had sighted this land in 1687 while on a voyage to Siam. They made their land fall in latitude 31 deg. south (a little to the north of the Swan

River), and coasted the country for some distance, keeping two or three leagues off shore, and finding an open sea, though such charts of this region as they had showed a mass of rocks and reefs extending for 12 or 15 leagues out to sea. "According to appearance the lands are habitable and im-"portant," wrote De Voutron. He asserted that the Dutch knew much more of this country than they chose to tell, and states that their pilot had been strictly forbidden on pain of punishment to give to foreigners any information about these coasts. He asked for two vessels of medium size and a smaller craft for use in shallow water, and mentioned the end of April or the beginning of May as the best time for an exploring expedition to set out from France. De Voutron urged that a port on the Australian coast would be of great value to the French trade with the far East.

On October 8, 1699, de Voutron renewed his request. His scheme was backed by one Renan, who describes him as a "man of stout heart who would not be repelled by difficul-"ties, one accustomed to deep sea voyages, as he had been "several times to the Indies."

SOUTH SEA BUBBLES.

It was in this same year that the British Admiralty sent out William Dampier in the *Roebuck* to explore the Australian coast, but de Voutron was less persuasive, or less fortunate than that eminent buccaneer. Interest in de Voutron's suggestion was apparently revived a few years later. Bouvet states in a memorandum written in 1735, that but for the death of du Vivier, the Captain who was to have taken command, a French vessel would in 1708 have been sent to explore the "land discovered by Dampier."

The year 1699 was marked by a great stirring of French interest in Southern exploration. Another document of that year is a "Memorandum on the Discovery of the Terres Australes" by Saint Marie. Saint Marie accepts as correct the alleged discovery in 1503 by a Norman Sea Captain named de Gonneville of a Southern Land which he, like others, is inclined to identify with Australia. De Gonneville stated that he had brought back to France a native of the new-found land named Essomeric, a chief's son, who settled in France and founded a family there. But even in France the de Gonneville story found critics. In a document written in 1738 Bernard de la Harpe claims that the story contains contradictions and impossibilities, and considers it more probable that de Gonneville, if he made the

voyage at all, reached some point on the South American coast.

In a later memorandum, undated, but written after 1745, since it states that in that year the English sent two vessels, the *George* and the *California*, to seek for a north-west passage to the Pacific, de la Harpe tells us that at the beginning of the 18th century there was a very active French trade with the Pacific coast of South America. He states that between 1703 and 1720 the inhabitants of St. Malo sent ninety-two vessels to the South Pacific. One of these, the *Francois*, was commanded by Marion du Fresne, no doubt of kin to the more famous Marion who visited Tasmania and New Zealand in 1772, and was the first white man to meet the aborigines of Tasmania. This earlier Marion was at Concepcion in Chile in 1714, when the Captain of a Spanish vessel told him that 400 leagues to the west and in latitude 38 deg. south he had fallen in with a high land and coasted along it for a day. De la Harpe received without question the theory that there was a great southern continent, quite distinct of course from Australia, a belief generally held until Cook proved that such a continent, if it existed, was confined to the Antarctic regions. Of this continent New Zealand, de la Harpe thought, formed part, and he conjectured that its inhabitants had crossed from Australia or Van Diemen's Land to New Zealand. Like de Voutron, he thought that a French Settlement in these Southern lands would largely control the trade "with India, "China, and the South Seas."

While de la Harpe was sceptical, Bouvet fully accepted the de Gonneville story. Bouvet tells us that in 1734 he had, in the *Dauphin*, bound to the East Indies, run down the easting till he sighted the Australian coast, "as almost all "the English now do." He urged the planting of a colony in the Terres Australes du Saint Esprit. In 1738 Bouvet set out in two vessels to search for the great southern continent armed in a model form for taking possession. But he searched in the stormy seas southward of the Cape of Good Hope, and found only Bouvet Island. In a memorandum written in 1767, Bouvet proposed another voyage, but nothing came of it. Incidentally Bouvet complains that Bougainville had stolen his ideas.

ACADIANS FOR SOUTHERN COLONIES.

In later years the English suspected the French of designs on Australia which apparently they did not enter-

tain. In these earlier days the French sometimes thought that the English ideas about expansion in the South Seas were far more definite than was actually the case. Bougainville, writing from the Falkland Islands, apparently in 1764, says: "The views of the English about forming establishments in the South Seas and in the neighbouring countries have long been known, but it is above all since the relation of the voyages of Anson that the English have decided to follow seriously the execution of these views." Bougainville states that they intended to seize the Island of Juan Fernandez.

Though Bougainville did not visit Australia, he anticipated a proposal made when the British did actually begin to think of settling in Australia. It was urged by James Maria Matra in 1783 that the American Loyalists expelled from the United States should be sent as settlers to Australia. Owing to delays and to other causes the idea came to nothing, though one or two United Empire Loyalists did reach Australia. We are, for instance, told of James Reid, who came out as a superintendent of convicts in 1789, that he had been a planter in America. Bougainville's idea was to use the Acadians of Longfellow's "Evangeline," expelled from the maritime province of Canada by the English, to found a new French Colony in the far south. He wrote in 1763: "As the modest funds of the owners of the vessel do not allow them to embark, at their own cost, large crews, they would ask the King for forty men, half soldiers and half Acadians. The soldiers should be men who have served in Canada, and are therefore accustomed to live in the woods, to rove and to traverse unknown countries. The Acadians are sailors and fishermen, and are the more recommended by the strong and constant proofs of attachment to France given since the Peace of Utrecht. They are most suitable men for founding a flourishing settlement. The Acadians who had made the voyage would determine their compatriots to transfer themselves to the south."

Bougainville had served under Montcalm in Canada, and had conceived the idea of indemnifying France for her losses in the New World by calling into existence French colonies in the "third part of the world" in the south. Unluckily, he took his colonising expedition and his Acadian settlers to the Falkland Islands, the Iles Malouines of the French, and as the result of Spanish objections the French colony was withdrawn after three years.

KERGUELEN'S VOYAGES.

In the year 1772 two French expeditions visited Australasia. The story of the voyage of Marion du Fresne and Crozet from Mauritius to Tasmania and New Zealand is well known, but a strange oblivion has fallen on the activities of Saint Allouarn on the western side of Australia. The name of Saint Allouarn is preserved by an island near Cape Leeuwin, and there are one or two casual references to his voyage, but no one seems to have suspected that he actually took formal possession of part of Australia for France. Saint Allouarn was a companion of Ives Kerguelen, who had set out from France to seek for the southern continent. This was the vast continent supposed to exist in the temperate regions of the southern hemisphere, the continent whose existence Cook finally disproved, a work which he considered of far more importance than the mere charting of the east coast of "New Holland." Had Cook had a better vessel he might never have visited Australia at all.

While Cook decided in 1770 that there was not much to be found between New Zealand and the Cape of Good Hope, though he had yet to prove that no southern continent existed between New Zealand and Cape Horn, Kerguelen was in 1772 still searching for a southern continent south-east of the Cape of Good Hope. After a visit to Mauritius he sailed to the Southward on January 16, 1772, in the *Fortune*, accompanied by Saint Allouarn in command of the *Gros Ventre*, a 300 ton vessel carrying 14 guns and a crew of 105 men. On February 13, they reached Kerguelen Land, which Kerguelen named La Nouvelle France, and took to be part of the long-sought continent. Next day a storm separated the two vessels. Kerguelen returned to Mauritius, but St. Allouarn bore away for Australia. Of his voyage two accounts are preserved in the Commonwealth Library. One is the log of the *Gros Ventre*, the other the Diary of Rosily, properly an officer of Kerguelen's vessel, who was on the *Gros Ventre* by accident. He had been sent in the sloop to sound on February 14, and managed to reach the *Gros Ventre* when the storm broke. The log tells us the land near Cape Leeuwin was sighted on March 17, 1772. Next day St. Allouarn sent a boat to reconnoitre, but those in it were unable to land. They caught many fish, but saw no signs of inhabitants. The *Gros Ventre* then sailed northward along the coast, missing the Swan River, discovered in 1697

by Vlaming, until March 30. The vessel was then in latitude 25 deg. 25 min. south, or somewhere about Shark Bay.

WESTERN AUSTRALIA CLAIMED.

The log continues: "At ten o'clock this morning M. de "Saint Allouarn sent a boat with an officer to reconnoitre "this land, supported by the boat's crew and five soldiers. "They effected a landing at a bay to the south south east, "and penetrated about three leagues into the country without "seeing a living soul. This land is sandy, and covered with "bushes and small scrub, as at the Cape of Good Hope. "M. de Mings, on returning to the coast, took possession of "the land, hoisting a flag and causing a notification of the "fact that he had taken possession to be read in the form "usual in such cases. The document was put in a bottle "and buried at the foot of a little tree. Near it were put "two crowns of six francs each. In the afternoon the sloop "went on shore with many persons. They traversed a space "of three leagues without finding any one. They returned "on board in the evening. They found on land traces of "some quadrupeds, and saw a kind of little fox. At 6 o'clock "in the evening the captain sent the boat on shore to bury "one Massicot, a gunner's mate, who had died that day of "scurvy. They were to pass the night and to see if they "could catch turtles in the great bay, but none came on "shore."

The log refers to this Bay as the "Baie de Prise de "Possession." It mentions that on April 1 the vessel entered the "Baie de Bricarloge," which no doubt means the bay of Dirk Hartog, or Dirk Hartog's Road, as Vlaming calls it, the Bay in which Dirk Hartog had anchored in 1616.

DESCRIPTION OF THE COUNTRY.

Rosily was evidently one of those who went ashore at the Baie de Prise de Possession. He says that with much difficulty they climbed up a steep sand hill covered with scrub. "From the top of this," he writes, "we perceived a "landscape extending away for seven or eight leagues. The "land rose imperceptibly, and we penetrated for about two "and a half leagues inland. We saw there many burnt "trees and others where it appeared that one had set fire to "the foot of them. I do not believe that it is the heat of "the sun that sets fire to these trees, for they are very green, "and in the night there is a very heavy dew that refreshes "them and gives them nourishment. We thought that we

"saw traces of men and of children, but we could hardly "distinguish them, because of the very shifting nature of "the sand. There was in particular one place as if it "appeared that people had danced in a ring. We saw there "animals like makis (long tailed monkeys) and others like "mangoustes (the ichneumon or Pharaoh's rat), and several "birds, including a kind of goose which had difficulty in "flying, but never allowed us to approach within gun shot. "Generally speaking, all the animals that we saw were very "wild. We found no water at all. I believe that the "animals drink only at night, taking advantage of the dew. "We found on the beach thousands of little tortoises no "bigger than your hand. The persons who passed the night "in catching them saw a large animal in the shape of a "dog which was scratching in this place in a search for the "eggs of the tortoises. We caught many very good fish with "the line, but could not succeed with the seine, the shore "being very steep."

Rosily states that the *Gros Ventre* was detained for eight days before she could get out of the Bay which she entered on April 1. She lost two anchors there owing to the strength of the currents.

The *Gros Ventre* left the coast on April 11, being then in latitude 20 deg. 44 min. south, and sailed by way of Timor and Java to Mauritius, which she reached on September 5. There Francois Alesne de Saint Allouarn, who had long been grievously sick, died a few days later, at the age of thirty-five.

KERGUELEN'S DOWNFALL.

As may be judged from the remarks of Rosily, about the lack of water, and the look of the country generally, Saint Allouarn's officers were not enthusiastic about the region round Shark's Bay of which possession had been taken. Kerguelen Land, on the other hand, was for the moment looked on as part of a great continent, and a discovery of capital importance. "In two months M. Ker-"guelen has discovered for France a new world," wrote M. Poivre, the Intendant at Mauritius, on March 21, 1772, when Kerguelen had just returned. In another note, however, M. Poivre wrote, "I have the honour to observe that the cost of "these expeditions ordered by the Court should not be borne "by the Colony." There was a fear that the English would try to get hold of the new "Continent." In a memorandum dated August 2, 1772, it is urged that Kerguelen should be

sent back without waiting to see what had become of the *Gros Ventre*. "A pressing incentive," says the anonymous but apparently official writer, "is the necessity of forestalling "the English, who, on the reports spread abroad of this dis- "covery, might seek to trouble at its inception our possession "of these lands of which the Commander of the *Gros Ventre* "has probably taken possession in the name of His Majesty." This refers, of course, not to Western Australia, of which Saint Allouarn had actually taken possession, but to Kerguelen Land. Kerguelen asked for three good ships, stating that the English were equipping four for an expedition to the South Seas. After a good deal of delay he went down to Kerguelen Land again, but was so buffeted by gales and beset by the ice and snow of that inhospitable region that he ran north to Madagascar, and then to Mauritius, and reported sadly that New France "offered no resources." Perhaps he would have tried the Australian coast for a change, but wine and wassail at Port Louis led to trouble. Eventually Kerguelen was tried by a court-martial, broken, and dismissed from the Navy. A book which he wrote was suppressed, and a score of years after his voyage, in the days of the revolution, he was still seeking to make good a claim to justice. There was a new Intendant at Mauritius by the time of Kerguelen's second Expedition, one Maillart Dumesse, and he had no sympathy with these explorations. In language of a kind not unfamiliar in our own day he urged that the first consideration should be the promotion of payable enterprises. Agriculture at Mauritius should be encouraged by importing negro slaves from Mozambique and cattle from Madagascar. "Our expedition," wrote Dumesse, in complaining of Kerguelen's requisitions for supplies, "should have no other objects than blacks and beasts "(noirs et bestiaux)."

French activity in Australasian seas continued for many years after this. It is enough to mention the great voyages of La Perouse, who put into Botany Bay when Sydney was a few days old, of D'Entrecasteaux and of Baudin, with later voyagers like Dumont d'Urville. But Saint Allouarn was the first and last to claim for France a foot of the soil of Australia.

TASMANIAN STATE RECORDS.

By J. MOORE-ROBINSON, F.R.G.S.

(Librarian and Publicity Officer, Chief Secretary's Department, Tasmania.)

[Originally written for the Hobart meeting of the Australasian Association for the Advancement of Science, January, 1921. Revised, and in part re-written, and read before the Royal Society of Tasmania, 8th August, 1921.]*

A careful consideration of all facts concerned compels the belief that, ranking in prime importance among State functions, is a proper preservation of State Records. Other processes being normally in a continual state of progression or development, can never share the innate quality of Records. Records do not develop—they are the imprint of current events. They stand alone in the world of Science.

Records have not been well treated by Australia since she took her place among the living entities of the earth. It is the exception to find important Records explicit and reliable. For instance, the very date of Captain Cook's discovery of the N.S.W. coast is now called in question, owing to an alleged error by the Great Navigator in his calculations in crossing the 180th Meridian, while sailing westward from Tahiti in 1770. It is true that December 1st, 1642, has never been challenged as the day on which Tasman cast anchor on Tasmania's coast; yet many different dates have been assigned to Bowen's Settlement at Risdon in 1803. The almanacs up to 1893 give the date of Bowen's landing as August 10th, 1803. In those of the following year that date is altered to September 12th, and later September 13th, 1803, is adopted. Curiously enough, in *Walch's Red Book* for 1920 the date is assigned as September 14th, owing probably to an error in copying. So careful an author as James Backhouse Walker writes ("First Settlement of the Derwent," *Early Tasmania*, p. 26):—

"I have searched in vain hitherto in printed "accounts for the correct date of Bowen's Settlement.

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* Owing to the Shipping Strike, the Meeting of the A.A.A S , which was to have been held in Hobart in January, had to be held in Melbourne. Many difficulties had to be overcome, and it was found impossible to publish the usual full report of the A.A.A.S. Meeting and to print all papers. Arrangements were, therefore, made for certain papers to be read before the Society and published in the Papers and Proceedings for 1921.

"The dates given vary from June to August, but I think "we may henceforth consider it settled, on the authority "of official documents, that the birthday of Tasmania "was Tuesday, the 7th day of September, 1803."

Walker's conclusion is not correct, and his error is due, not to lack of examination on his part, but to the careless, inconclusive, and incomplete Records of the period. Bowen himself reported that he arrived at Risdon "on Sunday, "September 12th, 1803." As a matter of fact he made an error in the day of the month. The correct dates of that important event are:—

Lady Nelson (tender) arrived at Risdon Cove at 6 p.m. on *Thursday*, September 8th, 1803.

Albion (with Bowen on board) arrived at 8 a.m. on *Sunday*, September 11th, 1803.

Proof of these dates is given by Dr. F. Watson, Editor of the *Australian Historical Records*, Series III., Vol. I., and to that author much credit is due for patient investigation and careful examination. In these circumstances it is pleasant to be able to state that the Records of the Tasmanian Government give great promise of affording not only verification of disputed statements, but the discovery of new and important facts.

One specific instance of the latter will suffice on this point. The exact history of Port Arthur has always been regarded as a lost possibility owing to the non-existence of earlier Records of the famous Settlement. It was loosely stated "that Port Arthur was born in 1830." The Tasmanian Historians, West (1862) and Fenton (1884), totally ignore so important a point. Since commencing the work of indexing the MS. Records in the Chief Secretary's Department, I have been fortunate enough to find:—

(1) Governor Arthur's autographed Minute dated September 7th, 1830, giving instructions to found Port Arthur.

(2) The Report to Arthur of Assistant Surgeon John James Russell, the first Commandant, dated from the Settlement October 2nd, and giving details of his landing there on September 22nd, 1830.

(3) Several other documents relating to the same subject.

These documents establish with authority, not only the exact date of the Settlement's birth, but the more important fact that at least in the beginning it was not designed as the ultra or super-penal station into which it afterwards developed, and from which it has derived its somewhat unenviable fame. The dates and facts given in these documents are explicit, and though their detail is not as full as might be desired, they afford a sufficient ground on which Port Arthur's story may be accurately based. They establish the fact that Port Arthur was primarily designed as a timber station, which might indeed be worked by prisoners more suitable (owing to their bad conduct) for life away from convicts of better dispositions. But Russell's testimony is clear:—

> "Port Arthur," he writes, in the first Despatch referred to, "forms a fine capacious harbour, and from "the quantity of *good Timber* with which its Coast "abounds, I have no doubt but that it will answer *the "main object* of its establishment as a settlement."

Therefore, Port Arthur was designed and opened as a Timber station such as others then in existence at Birch's Bay and elsewhere.

Take another instance, that of Drake, England's greatest adventurer. Old Fuller, in his immortal *Worthies*, thus describes Drake: "A very religious man towards God and "His Houses, chaste in his life, just in his dealings, true of "his word, and merciful to those under him." Truly a model panegyric. Yet Drake had been accused not only of being a Pirate, but of being the murderer of his friend, that courtly gentleman Thomas Doughty. And but for the accidental discovery of a 16th Century Record, Drake's name might never have been freed from this suspicion. A lady, Mrs. Zelia Nuttall, student of Mexican Archæology, a few years ago, was pursuing her researches in the National Archives of Mexico, when she chanced on a dust-covered tome. On examination this proved to be the declaration of Nuno da Silva concerning his compulsory association with "Francisco Drac," who, it will be remembered, captured da Silva, and used him as a Pilot while on the Spanish Main. In his Declarations to the Spanish Inquisitors da Silva stated that Doughty challenged Drake's authority to behead him, and that Drake in reply, produced

> "some papers, kissed them, raised them to his forehead, "and read them with a loud voice."

All present recognised these as the warrants of Elizabeth of England, granting Drake, in terms similar to those used in the case of Richard Grenville, absolute power of life and death over all who sailed under him.

Thus has a Record—the musty Record of the Spanish pilot—proved the judicial execution of Doughty, and scouted the attainters of England's Sea Hero. Instances like this might be multiplied, but I am sure these two are sufficient to lend insistence to my claim for the completion and preservation of Records.

After this somewhat lengthy exegesis of Records in general, let me state the position relative to the Early Records of the Tasmanian Government.

Subsequent to the 24th of May, 1824, when Colonel George Arthur assumed the Lieut.-Governorship of Tasmania, the State Records are reasonably ample and complete, both in MS. and printed forms, and in narrative and in statistical styles. Prior to that period the Records are meagre, non-sequential, and altogether inadequate. Thus we have two prime Epochs with which I shall deal separately:—

FIRST EPOCH. PRE-ARTHUR.

This Epoch may be conveniently classified in three subdivisions:—

(a) *Discovery*, 1642-1803. This period begins with Tasman's discovery of Van Diemen's Land, and includes the successive discoveries and surveys effected by Marion du Fresne (1772), Furneaux (1773), Cook (1777), possibly La Perouse (1788), Cox (1789), D'Entrecasteaux (1792-3), Hayes (1794), Bass and Flinders (1798), and Baudin (1802). So far as Tasmanian ownership is concerned, no MS. exists of the work of these Early Voyagers. All we know of them has been learned from Records belonging to other peoples and nations. Not one stroke of the pen exists in Tasmania from the hands of this galaxy of illustrious Navigators.

(b) *Settlement*, 1803-4. The three names prominent in this period are those of Lieut. John Bowen, who on September 11th, 1803, landed at Risdon to form the first Settlement in Tasmania; Lt.-Col. David Collins, who on the 21st February, 1804, founded the present capital of Tasmania; and Lt.-Col. Wm. Paterson. The latter arrived at Port Dalrymple (River Tamar) on November 4th, 1804, in H.M.S.

Buffalo, but that ship dragged her anchor during the night in a strong gale from the North-West, and went aground. As a consequence, seven days were lost before Col. Paterson came to a safe anchorage, and on November 11th, 1804, effected the beginning of Settlement in the North of this Island, which he named George Town.

To these three names, or perchance more fairly to the Navigators of the Discovery Period, should be added the name of William Collins. This officer (later Hobart's first Harbour Master), who came out with Governor Collins to engage in the Seal Fishing, was despatched from Port Phillip to examine Port Dalrymple, and landed there from that famous ship in Tasmanian history, the *Lady Nelson*, on January 1st, 1804, three and a half months after Bowen had landed at Risdon. Wm. Collins spent three weeks examining the Tamar, and was much impressed, claiming its beauty to be "not surpassed in the world." The credit of this voyage, however, must be shared between Wm. Collins and Lieut. Symons, who commanded the *Lady Nelson*.

Of this period, too, Tasmania possesses no written Records. We have at our disposal only the Records of other States, which, however, are sufficient to give us a fairly clear view of all the leading events. But these, even the official Reports and Despatches, are lamentably lacking in those details which the Historian finds so necessary to enable him to obtain correct colour and evolve an accurate perspective.

(c) *Occupation*, 1804-1824. It is a period of marked laxity in almost every Department of Government, a laxity in none more marked than in that designed for the preservation of official Records. I do not desire to place individual blame, for that would be manifestly unfair. Circumstances fortuitously guided to an unfortunate end. Official jealousies, the lack of instructions, personal weakness, the vacillations of the Home Government, and many other forces active and passive, combined to the unhappy result, the which it is no part of my purpose to enter into here. Our Records, official and private, of this period are hopelessly inadequate, especially when we reflect that it is the real foundation on which the fabric of Tasmanian History should be built. A few Garrison Orders of Collins, the Journal of that worldly divine, the Rev. Robt. Knopwood, some transcripts of letters and despatches by Governor Sorell, some second-hand statements, generally garbled, concerning Commandants Giel, Murray, and others, the incidental light shed by Despatches from the Governor in

Chief to the Home Government; a few Court Documents and Survey Records, and the terse official notes and notices of the *Hobart Town Gazette*, which began publication on June 1st, 1816; these, and a few odds and ends, are the main bases on which the story of the years 1804 to 1824 has to be founded.

I will tabulate those that have come under my own notice:—

(1) Our Survey Department has some interesting Records of Land Grants, Buildings and Allotments, Statements of Fees, etc., which are being indexed, and so made available.

(2) We have a priceless original Land Grant dated December 18th, 1805, signed by Philip Gidley King, devising that "Henrietta Farm" of 100 acres on the banks of the Derwent, to Henry Hayes. This is, I believe, the oldest land document extant relating to Tasmania. In the Chief Secretary's possession.

(3) A MS. Map dated 1803 of the country East of the Derwent, by James Meehan, with that Surveyor's Field Books. In possession of Lands and Survey Department. This map, the oldest extant of Tasmania, has some curious and interesting features. These are dealt with in my *Tasmanian Nomenclature* published in 1911, and by Mr. T. Dunbabin in some articles published in *The Mercury* in 1912, and headed "In the Map Room."

(4) Two type-written copies (in the possession of the Royal Society of Tasmania) of some of Governor Sorell's Letters and Despatches dated 1818.

(5) A Book half full of Drafts and Letters to Home Government Departments by various Governors from 1818 to 1824. His Excellency the Governor has kindly allowed me to peruse this book, which is in his official possession.

(6) A book of some of the Records of the Judge Advocates Court. It is endorsed "No. 7," and dated from June 2, 1823. This is in the Chief Secretary's Vaults.

(7) Sundry Deeds and Bonds, fragmentary and disconnected, dated from 1819 onward. In the Chief Secretary's Vaults.

(8) Some unexamined Files of Correspondence which Dr. Watson and I recently found at George Town, and which are now in the possession of the Chief Secretary.

(9) A complete File of the *Hobart Town Gazette* (Government), commencing with Vol. I. on June 3rd, 1816. In the Chief Secretary's Vaults.

(10) Some Muster Rolls recently discovered at Launceston.

SECOND EPOCH. ARTHUR AND ONWARDS.

MS. CORRESPONDENCE. In the vault of the Chief Secretary, we have an invaluable collection of MS. official documents, filed from the beginning of his Regime, by Tasmania's most noteworthy Governor, Col. George Arthur. Counting to the beginning of the present century, these form a library of about 2,600 volumes, averaging about 270 pages. I am engaged in preparing these for careful investigation by compiling a Card Index of Subject, Authors, and including, where possible, the names of such prominent persons as appear. Owing to the pressure of other work, progress has been slow, but the Commonwealth has given assistance, and I am hopeful of proceeding much faster this year, and expect to have the bulk of the work done inside two years. Certain Indices and Registers exist in reference to this MS., but they are not of great value owing to (1) confused method of indexing, (2) missing files, (3) the cumbrousness involved in such a system when the dates of Files range over nearly eighty years. These disadvantages will disappear under a consecutive Card system.

These 2,600 volumes contain certain correspondence of a most valuable character (as, for instance, the beginnings of Port Arthur, referred to above), and I am hopeful that a careful search will reveal matter of utmost importance. Original Shipping Records are bound up indiscriminately in these Files, and when collated should afford intensely interesting side-lights, indeed lights of primary importance, on our early history.

GOVERNOR'S DESPATCHES. In the vault, too, is a complete series of Governor's Despatches, outward and inward, from 1824 to 1856. These, as might be expected, form a reasonably complete epitome of official acts and observations during the period covered. They have never been carefully examined, and when indexed may be expected to yield a vast number of facts, some quite new to the Historian. Some of them are the duplicate copies sent to the Secretary of State; others original copies, and some copies for filing. I do not know how the first named were returned to Tasmania, or by whose authority.

NEWSPAPERS. The vault contains bound volumes of Tasmanian Newspapers. The earliest of these are the *Colonial Times* of 1826 to 1856, the *Hobart Town Courier* of 1827 to 1859, the *Australasian* of 1824, *The Tasmanian* of 1826, *The Cornwall Chronicle* of 1835 to 1880, *Bent's News* of 1834 and 1837-38. The Volumes of these Newspapers are numbered and catalogued, but otherwise the information they contain is only available after arduous and exhausting search, "Page upon page, and line upon line."

HOBART TOWN GAZETTES. The Government has also a complete set of these from No. I., Vol. I., June 1st, 1816, to the present date. This set is a veritable mine of information, which, like that of the old newspapers, is not readily available. If these Volumes and the Newspapers were indexed in regard to news items, even up to the year 1850, some surprising facts would be brought to light. It is a work that I hope to see done.

THE BONWICK TRANSCRIPTS. No list would be complete without reference to the result of Mr. James Bonwick's work, undertaken at the request of the Tasmanian Government, and completed in 1892. Mr. Bonwick copied papers, some in the official custody of the Imperial Government, and others preserved in the British Museum. These include valuable documents relating to the discovery and settlement of Tasmania and New South Wales. Among them is to be found a copy of *Tasman's Journal* in Dutch (British Museum) and a copy of Woides' translation of it. The latter contains three several points quite new to History. I am hopeful of seeing it in print in the near future, as it is too good to be lost. The transcripts were largely used by the late James Backhouse Walker in preparing that series of monographs read before the Royal Society, and published in a Memorial volume called *Early Tasmania,* which entitled their author to be counted among the chief of Tasmania's historical writers. Much of the matter contained in these Transcripts is being published in that valuable Commonwealth enterprise, *The Historical Records of Australia,* under the able editorship of Dr. Frederick Watson, referred to above.

PARLIAMENTARY PAPERS. It is, I suppose, hardly necessary to state that the vault contains a complete set of Parliamentary Papers since Responsible Government in 1856, and the enactments of the earlier Legislative Council from 1837.

GAZETTES OTHER THAN TASMANIAN. Our collection of these is interesting and valuable, although rarely used. It includes:—

(1) *SYDNEY Gazette*, 1833 to 1864.

(2) *LONDON Gazette* (bound), 1839 to 1874. Unbound to date.

(3) *WEST AUSTRALIA Gazette*, 1824 (No. 287) *et seq.*

(4) *SOUTH AUSTRALIAN Gazette*, 1842 (No. 212), *et seq.*

(5) *VICTORIAN Gazette*, June, 1852, *et seq.*

(6) *QUEENSLAND Gazette*, 1860, 1861, 1863, 1864, 1865, 1866, 1867.

(7) *NEW ZEALAND Gazette*, 1843 to 1866.

(8) *AUCKLAND, WELLINGTON, SOUTHLAND and OTAGO Gazettes*, various dates from the fifties.

(9) *CAPE OF GOOD HOPE Gazette*, January, 1847, *et seq.*

SOME SUGGESTIONS.

I do not wish to close this paper without suggesting practical application of its main purpose. I am certain that if Governments realised the value, actual and historical, of their old Records, they would have them properly indexed and available for use.

I think that a useful first step would be for all the State Governments to get into communication with a view to each having returned to its possession any documents now held by another Government.

The next step would be to arrange that all historical matter held by State Governments should be arranged, collated, and indexed on a system common to all. This is an important aspect, which will be appreciated most by those who have had the task of hunting up information in more than one State.

A further step would be an endeavour to obtain repossession of any official documents which by one means or another have strayed from official custody.

I need scarcely stress the great advantages which would accrue if the State officers in charge of Historical Records were to be in constant communication with each other.

By these means Australia would gradually build up a solid, authoritative, and complete foundation upon which Australia's historian, when he eventuates, would be enabled to construct an historical fabric worthy of our Commonwealth, and worthy, too, of those indomitable spirits who, preceding us, have shaped for us so goodly an heritage.

CONCLUSION.

It is impossible to conclude this paper without making reference to the interest, no less than the courtesy and kindness, of the Honourable the Premier of Tasmania (Sir Walter Lee) in regard to its subject matters. The Government of which Sir Walter Lee is Premier has taken a keen interest in the Historical Records of the State, and has kindly conceded to me the privilege of committing to paper for the first time in the State's History the facts concerning Tasmania's Records, set out here. I feel this to be a great boon. The Under Secretary (Mr. D'Arcy Addison, I.S.O., M.V.O.) and Mr. Charles F. Seager (Acting Under Secretary) have been equally sympathetic.

It only remains for me to express the hope that, in the not far distant future, the secrets held latent in Government Vaults will be unveiled for the credit of the giants whose doings the Records chronicle, and the profit of those of this generation who tread the tracks they hewed out for us with so much labour.

JUNGERMANNIA STYGIA, HOOK. F. ET TAYL.

By Wm. Hy. Pearson, M.Sc., A.L.S.,

Plate XXIII.

(Read 19th September, 1921.)

In Mr. Rodway's interesting and useful List of Tasmanian Hepatics (Proc. Royal Soc. Tasm., p. 74, 1916) reference is made to this species, and also to *Cesia erosa*, Carr. et Pears.

The following notes will clear up some misunderstanding with reference to these species.

In Hooker's *Flora Antarctica*, *Jungermannia stygia* is described and figured as follows:—"Perpusilla, caule erecti, "laxe caespitoso ramoso, foliis erectis, subimbricatis, "appressis, obovatis, integris v. emarginatis, perichaetiis "rotundatis, caule duplo latioribus. (Tab. LXII., Fig. IV.)

"Hab. Campbell's Island, on rocks on the hills, growing "amongst other Hepaticæ and Mosses.

"Caules 2-3 lin. longi, crassiusculi, superne fusco v. atro-"purpurei, inferne fusco-olivacei, vage ramosi; ramis divari-"catis. Folia minima, subsecunda, alterna, vix imbricata "obovata v. oblonga, apices versus obtusos late emarginata, "segmentis obtusis, rarius integra, margine superiore inter-"dum scariosa. Perichaetia subrotunda, foliis imbricatis, "latiusculis, ad apices albidos, pleurumque scariosis.

"A very inconspicuous little species approaching *J. con-"cinnata* (Lightf.), of which it is probably the representative "in these islands; the leaves are, however, more distant, never "bifid at the apex, the stem slenderer, and the perichætia "sessile and round. Its colour is like *Gymnomitrium adustum*, "Nees, a German plant, with short and simpler stems."

In the Manchester Museum there is an original specimen of *Jung. stygia* from Campbell's Islands, and I have had the opportunity of microscopically examining the same; it is composed of two quite different species, one, which is figured by Hooker, being a round-leaved species, probably a *Jamesoniella*, and a *Gymnomitrium*, which it would be difficult to distinguish from *Gym. concinnatum* (Lightf.). Evidently the two species have been described as one, but with Hooker's

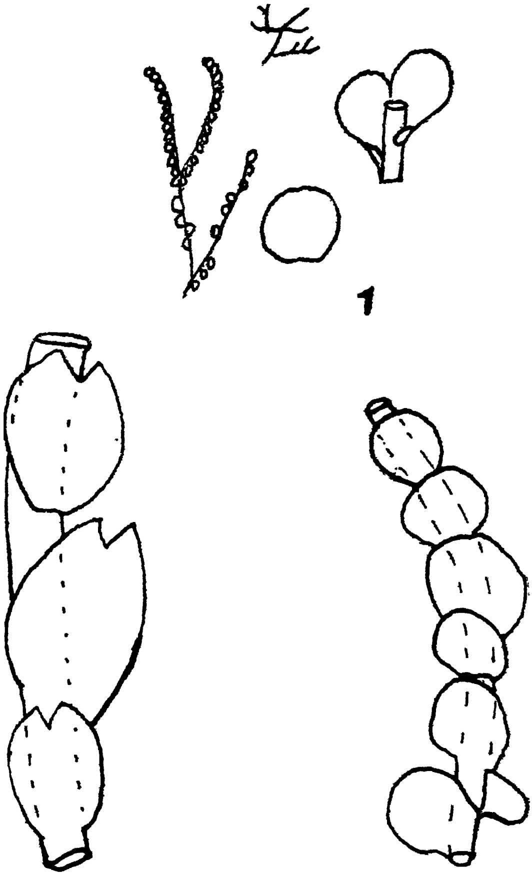


Fig. 1. Copy of Hooker's figures from *Flora Antarctica*, Pl. LVII., fig. IV.

Fig. 2. *Gymnomitrium stygia* (H. et T.) Pears: x 50.

Fig. 3. *Jungermannia*, growing with *G. stygia;* x 50. (Campbell's Island, Hooker, original, ex herb. Manchester Museum.)

notes in English, that his *Jung. stygia* is related to *Gym. concinnatum* and *Gymn. adustum*, we may reasonably conclude that the stems of *Gymnomitrium* were his type of the species, so, as I have been unable to distinguish them from *Gymn. concinnatum*, I consider it as a synonym of that species.

Further, Mr. Rodway writes under *Gymn. concinnatum* (Lightf.), Corda (Trans. Roy. Soc. Tasm., p 74, 1916):—"In "exposed situations on mountains the leaves more closely "appressed and entire; marginal cells elongated and irregular, "forming an erose colourless border.—*Cesia erosa*, C. et P." With this opinion I cannot agree.

The late Dr. Carrington, who was one of the most careful students of the Hepaticæ, and who spent endless time in their study, and before publishing anything as new would for weeks and months let his mind play freely round any species he was studying, had an undoubted opinion that *C. erosa* was a good and new species. I candidly admit that the specific name is misleading. One would naturally infer by the term "erosa" that the leaves were weathered, hence its name; on the contrary, although the leaf margins are irregular, they are bordered by a row of acute elongated cells, somewhat similar to those on the margin of the leaves of *Gymn. crenulatum* (G.). It certainly has no similarity to *Gymn. concinnatum* (Lightf.), to which Mr. Rodway refers it; this species is diœcious, whereas *Gym. erosa* is monœcious.

Stephani (Sp. Hep., vol. II., p. 3, 1906), under the generic name of *Acolea*, places *G. erosa*, C. et P., as a synonym of *Acolea stygia* (H. & T.) St. The above notes will show how mistaken he is.

He also refers *Gymn. vermiculare*, Schiffner (Ex. Gazelle, IV., p. 2), to *Acolea stygia*. Generally Schiffner's figures are very illustrative, but in this case it is difficult to make out what the species is; however, Schiffner is well able to defend the specific value of his species.

EXPLANATION OF PLATE XXIII.

Fig. 1. Copy of Hooker's figures from *Flora Antarctica*, Pl. LVII., fig. IV.

Fig. 2. *Gymnomitrium stygia* (H. et T.), Pears; x 50.

Fig. 3. *Jungermannia*, growing with *G. stygia*; x 50 (Campbell's Island, Hooker, original, ex herb. Manchester Museum.)

DESCRIPTION OF TWO TASMANIAN ABORIGINAL CRANIA.

By W. Lodewyck Crowther, D.S.O., M.B.

and

Clive Lord (Curator of the Tasmanian Museum).

Plates XXIV. and XXV.

(Read 10th October, 1921.)

In a previous paper (P. and P. Roy. Soc. Tas., 1920) we compiled a complete list of the osteological specimens, relating to the Tasmanian Aborigines, contained in the Tasmanian Museum.*

Two of the specimens mentioned in the published list present features worthy of comment, and in the present instance we desire to place on record a short description of the specimens catalogued as No. A. 298 and No. A. (E.H.) 558.

Both are crania which have been added to the Museum collection in recent years. The former was discovered at Tasman Island, and presented to the Museum by the Marine Board of Hobart. It was found in a penguin (*Eudyptula*) rookery, and was not in association with any other bones, careful search in this direction yielding nothing. Apart from the anatomical details of the skull, the locality of its discovery is of interest.

Tasman Island is in reality an enormous outcrop of rock lying off the South-East corner of Tasmania. Its cliffs, in most cases, rise for hundreds of feet sheer from the sea. The coast of the mainland, for several miles in both directions from the island, presents a massive bastion of diabase—an inhospitable coast upon which the surges of the Southern Ocean beat with relentless force. Between the island and the mainland the narrow channel is usually seething with the force of the tide rip.

In view of the foregoing, one cannot but wonder how the Tasmanian woman, whose skull is now included in our national ethnological collection, was able to reach the island

*Since that list was published the Tasmanian Museum has obtained five additional crania, three by purchase and two by exchange.

at all. Did she set out in one of the rough bark rafts of the natives to satisfy her curiosity as regards the island, or was she blown off shore by accident, and managed to swim to the island and climb its cliffs? Such questions naturally arise, but to a large extent they must remain unanswered. All we know is that the islands off the coasts were certainly visited by the natives, and that Tasman Island, despite the difficulties to be overcome, was no exception to the rule. This is proved by the fact that numbers of aboriginal stone implements are to be found on the island.

As regards the second cranium (No. A. (E.H.) 558), we are again at a loss to account for the fate of the Tasmanian male and the party to which he belonged. The cranium formed part of the Eaglehawk Neck discovery, the facts in connection with which have already been placed on record in the Papers and Proceedings of the Royal Society of Tasmania for 1918 (p. 118).*

In both cases the crania were very friable and worn by sand and exposure. Some slight restoration had, of necessity, to be made in order to provide for the adequate preservation of the specimens. Such restorations were carried out as carefully as possible, and done in such a manner as to interfere as little as possible with the correct anatomical details of the specimens.

TASMAN ISLAND SKULL.

(Tasmanian Museum, No. A. 298.)

The skull is that of an adult woman, and comprises the greater part of the cranium and face, as well as the mandible, the latter being in two portions.

The remains lying for many years on the left side, and being gradually uncovered, the wind and weather have disintegrated and removed the greater part of the right side of the cranium.

This has also happened to the face; the right malar and part of the external surface of the maxilla being wanting. The right parietal, almost in its entirety, and part of the left are also absent. Of the frontal, the outer table and greater part of the right half of this bone have disappeared, as also have the greater part of the occipital and right

*Since the first discovery further detailed examination of the site has been made by Mr. W. H. Clemes, with the result that a chipped stone implement has been found.

temporal. The *Pars glabellaris* is of interest. Here the outer table has weathered away, and no air cells or sinus are to be made out. In this respect, the specimen differs very materially from the more strongly developed cranium from Eaglehawk Neck (A. (E.H.) 558), also described in this paper. Sexual characteristics of the crania would explain this at least in part.

In spite of the absence of the cells, which might very reasonably be assumed to have a considerable part in the formation of the prominent glabella, this latter feature is as typically marked as in the average Tasmanian skull.

The mandible, recovered at the same time, wants portion of the right ramus, and has been broken into two fragments. This has since been restored.

The great interest of this skull, apart from the locality of its discovery, lies in the palate, together with the superior and inferior dental arches. The teeth are perfect, all 32 being in position. The general conformation of the palate and arches, with the tendency to elongation, and the parallel nature of the alveolar borders are points of much interest. (Plate XXIV.)

It has already been noted that the extinct Tasmanian race approaches more closely to the anthropoid apes than other races do, in the arrangement of the molar teeth and their tendency to be set in approximately parallel rows on each side of the palate. Such characteristics are well shown in the specimen at present under review.

The following measurements are given:—

Palato-maxillary, length*	64 mm.
Measurements between outer borders of 3rd molars	61 mm.
Measurements between outer borders of 1st molars	57 mm.
Combined length of molars and premolars (R.)	48.5 mm.
Combined length of molars and premolars (L.)	47.5 mm.

The whole palate has an excavated appearance, the horizontal processes being deeply set.

Depth at 3rd molars	12 mm.

*Margin of error in this measurement owing to the disintegration of the process of superior maxilla, posterior to 3rd right molar.

Palate of Skull of Tasmanian Aboriginal from Tasman Island. (Tas. Museum A. 298.)

Interval between internal margins of
3rd molars .. .. 35.5 mm.
Interval between internal margins of
1st premolars .. .. 28 mm.
Maximum length of skull .. .. 178 mm. (Approx.)
Maximum height of skull .. .. 128 mm. (Approx.)
Maximum breadth of skull (Impossible to measure with accuracy, owing to disintegration.)

EAGLEHAWK NECK SKULL.

(Tasmanian Museum, No. A. (E.H.) 558.)

This cranium consists of the greater part of the Frontal, right and left Parietal, and Occipital bones. Two small portions of the temporal articulations have been recovered and replaced in their correct positions. The calvarium itself is in very fair preservation. In several places the outer table is wanting.

Inferior to the right temporal ridge; immediately above the glabella; and in the sagittal suture 55 mm. posterior to the bregma, are cavities throughout the whole thickness of the bone. The loss of bone above the glabella enables the conformation of the frontal sinus to be made out, and shows this to consist of three large and several smaller air cells, the largest of these being over 20 mm. in length by 14 mm. in breadth. This central space is connected directly with the large cell of the right side, but not apparently with that of the left. The disintegration of the orbital and nasal portions of the bone allows only parts of six air spaces to be identified.

It appears that in this cranium the great development of the glabella is associated with and is proportional to the marked development of the air cells of the frontal sinus.

The frontal eminences are not marked, and no remains of the frontal suture are to be made out, nor any flattening immediately behind the glabella. The superciliary ridges, like the glabella, are well marked. The supra-orbital notches are represented by two shallow grooves 5 and 7 millimetres broad, on the right and left sides respectively.

Passing backward in the median line, and 45 mm. anterior to the lambda, is a large parietal foramen, 1 mm. to the right side of the sagittal suture. The thickness of the vault is 4 mm. The cerebral fossæ are deep and circular rather than ovoid in shape.

The feature of greatest interest in the skull is its remarkable resemblance, in point of general configuration

and actual measurements, to that of *Homo primogenesis*, as represented by the Neandertal skull. As instancing this, the following measurements are given:—

	Homo primogenesis (Neandertal) (From Munro's *Prehistoric Britain*)	*Homo tasmanensis.* (Tas. Mus. No. A. (E.H.) 558)
Ant.-Posterior (Max. Dia.) ..	200 mm.	205 mm.
Transverse (Max. Dia.)	144 mm.	148 mm.
Frontal (Minimum)	106 mm.	115 mm.
Frontal (Maximum)	122 mm.	*117.5 mm.
Cephalic Index	72 mm.	72.19 mm.

The points that the Tasmanian skull emphasised more thoroughly than any recent race were the prominent glabella, superciliary ridges, and narrowing (post-orbital) of the frontal bone. It will be seen how these compare with the Neandertal skull, the actual measurements of the two skulls being very similar. The Tasmanian skull does not, of course, present the marked flattening of the cranial vault which is so characteristic of *Homo primogenesis*. The *Pars glabellaris*, whilst very prominent and pronounced, has not the rugged projection of the Neandertal skull; in consequence, the narrowing of the frontal bone is not thrown into such strong relief as in the latter.

Not having the actual measurements of the Neandertal calvarium we are not able to compare the superior portions of the occipital of A (E.H.) 558 with it. Attention has, however, been drawn to the depth and shape of the cerebral fossæ.

EXPLANATION OF PLATES.

Plate XXIV.

Palate of Tasman Island skull (Tas. Mus. A. 298).

Plate XXV.

Fig. 1. Reduced outline (*Norma lateralis*) of Tasmanian Aboriginal skull (Tas. Mus. A (E.H.) 558).

Fig. 2. Reduced outline of Neandertal skull, from cast in the Tasmanian Museum.

(Note:—In the absence of a dioptograph these outlines were obtained from actual photographs of the Specimens.)

*Between existing processes.

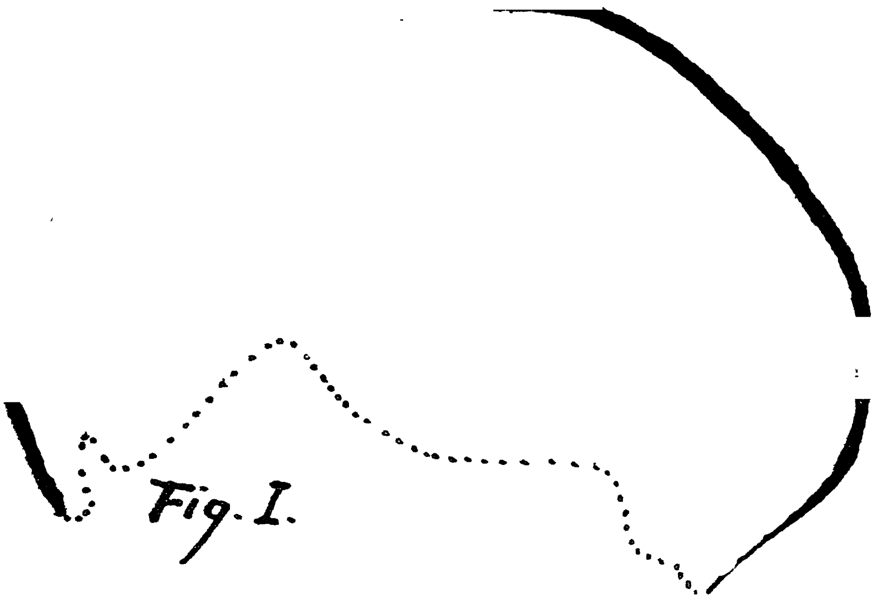


Fig. I.

Fig. 2.

Fig. 1. Outline of Tasmanian Aboriginal Skull (Tas. Museum A. (E.H.) 558.)

Fig. 2 Outline of Neandertal Skull.

BRYOPHYTE NOTES.

By W. A. Weymouth and L. Rodway, C.M.G.

(Read 10th October, 1921.)

In the description of the Mosses of Tasmania recorded in Papers and Proceedings for 1913, a specimen of *Ephemerum cristatum, H.f.W.*, not being available, Mitten's description was used. This is vague and insufficient to assist the junior student. The plant is minute, barely one millimetre in height, the capsule is globose as in *Acaulon*, but the leaves are very distinct. These are of thin texture, ovate-acuminate, the margin and midrib armed with relatively long simple or compound spinous processes. The cells are rectangular, but very irregular in size and shape. This description is from a specimen gathered at Bellerive by A. J. Taylor in 1886.

Mitten described a plant and named it *Trematodon flexipes*. It was gathered at Cuming's Head, Western Mountains. For some reason Dr. Brotherus, in Pflanzenfamilien, refers it to *Campylopodium* as *Campylopodium flexipes (Mitt.) Broth.*, though it has the typical arcuate capsule with a long apophysis of *Trematodon*.. The plant described under Brotherus' name in the description of Tasmanian Mosses above referred to, is *Campylopodium euphorocladium (C.M.), Besch.* The true *Trematodon flexipes, Mitt.*, does not appear there at all. Mitten's plant is:—Small, subulate, entire leaves, with a broad nerve occupying the upper three-fourths of the leaf, margin entire. Seta about 5 mm., flexuose; capsule inclined, oblong, 1 mm., with a long slender apophysis; lid with an inclined slender beak slightly longer; calyptra dimidiate, inflated. Peristome with deeply cleft teeth.

The following are new to Tasmania, and determined by H. W. Dixon:—

Trematodon mackayi (R. Br. Ter.), Dixon. Stem 2-3 mm. Leaves with a broad sheathing base and a long subulate lamina 4 mm. Seta straight, 10 mm. Capsule narrow oblong, inclined to arcuate, 2 mm., tapering into a slender apophysis 3 mm., lid with a slender rostrum 1 mm. Peristome, none.

West Coast. T. B. Moore. Also New Zealand.

Pottia heimii (Hedw.), Feurn. Small, erect, 6-10 mm. Leaves narrow-ovate, acuminate, acute, 2 mm., with a few serrations towards the apex; nerve slender, continuous, or

vanishing below the apex. Seta slender, erect, 12 mm.; capsule erect, oblong, 1 mm., peristone none, mouth broad; lid with a slender rostrum.

Locality unrecorded. W.A.W.

Differing from *P. subphyscomitrioides*, chiefly in the serrate margin and non-excurrent nerve. Range, cosmopolitan.

Pottia melbourniana, Dixon. Small, seldom exceeding 2 mm. Leaves oblong-spathulate obtuse, but apiculate, margin entire but closely revolute below, nerve bold, dissolved in the apiculate apex. Seta erect, 3-4 mm.; capsule broadly oblong, with a wide mouth barely 1 mm., lid with an oblique rostrum.

Glenorchy. W.A.W. Also Victoria.

Ditrichum punctulatum, Mitt. Slender, in dense cushions, about 2 cm. long. Leaves narrow linear-subulate from a long, narrow, sheathing base, 5 mm., acutely serrate towards the apex, nerve broad, cells oblong, shining and twisting when dry. Seta 1.5 cm., capsule erect, narrow cylindric, 2 mm., mouth constricted. Peristome teeth short, slender, unequal. "In *D. elongatum* the leaves are dull and "little twisted, otherwise they scarcely differ at all. But the "fruit is different" (Dixon).

Navarre Plains, near Mt. King William. Also Mt. Field.

Dicranum trichopodum, Mitt. Yellow-green tufts on bark. Leaves slender, little secund, 6 mm., nerve broad, flat, excurrent, and occupying the upper half of the leaf, wings narrow, cells oblong above, longer towards the base, strongly incrassate, more or less serrate towards the apex, a broad auricle of numerous brown quadrate cells. Seta slender, capsule erect, narrow, lid with a very long rostrum.

Cradle Mountain. Also New Zealand.

Mnium rostratum, Schrad. In loose, dark green trailing tufts with short erect fertile stems. Leaves shortly decurrent, broadly obovate, those of the coma spathulate (Braithwaite). Margin limbate generally serrate above, nerve continuous into a short apiculus or lost just below the apex. Seta long, slender, capsule pendulous, elliptic, 2.5 mm., lid shortly rostrate, exostome and endostome typical.

Gould's Country. W.A.W. Also England.

Macromitrium rodwayi, Dixon. Dark purple-brown, in dense masses on wet diabase rock on sea coast, apex yellow-green. Stems 1-2 cm., densely covered with leaves. Leaves

linear-lanceolate, acute, 2 mm., nerve solid usually excurrent in a short smooth point, margin entire.

On dripping rock at the entrance to Port Arthur.

Mr. Dixon notes that it is near *M. peraristatum, Brotherus*, of Lord Howe Island. From this it differs in being a much smaller, denser plant. "But the leaves differ "in one or two ways, which I think are of importance. In "your plant the narrow basal cells occupy only a small por-"tion of the leaf; while in *M. peraristatum* they are extremely "narrow and sinuous, and occupy more than half the leaf, "sometimes considerably more. In addition to this, the leaves "in *M. rodwayi* taper gradually to a very acute apex, and "the nerve becomes indistinct near apex, and does not appear "to be excurrent, whereas in *M. peraristatum* the apex is "rapidly narrowed and scarcely acuminate, while the nerve "runs out very distinctly into a longish cuspidate point." H. N. Dixon.

Leucobryum brachyphyllum, Hampe. This moss has the habit, structure, and fruit of the common *Leucobryum candidum*, but very different foliage. With the latter the leaves are narrow lanceolate, tapering to an acute apex, and about 4 mm. long, but with *L. brachyphyllum* the leaves are lanceolate to oblong, with a short, serrate apex or apiculus, and mostly but 2 mm. long.

Weldborough. W.A.W.

ON *POLYPORUS PULCHERRIMUS.*

BY L. RODWAY, C.M.G.

(Read 10th October, 1921.)

Polyporus pulcherrimus, n.s. Dimidiate sessile, simple bracket or irregularly proliferate, generally about 10 cm. diameter, bright crimson throughout, fleshy, very watery, the dorsal surface roughly verrucose-strigose with no distinct dermis. Pores very irregular mostly about one millimetre diameter, dissepiments very thin and irregular at the mouth. Spores hyaline, very broadly oblong, 6 x 5 μ diameter.

Commonly on the trunk of our Evergreen Beech, rarely on a Eucalypt. It is a wound parasite, but spreads to the living wood. Mr. C. G. Lloyd, to whom I submitted this fungus, points out the close relationship to *Polyporus confluens*, from which it differs in the absence of a differentiated dermis, crimson colour, growing on trees, more watery consistency, and rather larger oblong spores.

A SUPPLEMENTARY NOTE TO A PRELIMINARY SKETCH OF THE GLACIAL REMAINS PRESERVED IN THE NATIONAL PARK OF TASMANIA.

By A. N. Lewis, *M.C.*

(Read 14th November, 1921.)

In a paper read by me before the Royal Society of Tasmania on 11th July, 1921, on the above subject, I stated: "As far as can be ascertained, the glacial remains on the "Mt. Field ranges have never been described. They do not "appear to have been observed, or at least their existence "recorded, before the proclamation of the area as a National Park. There is, therefore, no previous literature on the subject to which to refer."

Since publishing these statements my attention has been drawn to a paper, entitled "Climatic Cycles," published by Dr. (now Professor) Griffith Taylor, of the University of Sydney, in the American Geographical Review of December, 1919, in which, at pp. 292-3, he mentions the existence of glacial remains, cirques, moraines, etc., in the National Park, and also to the fact that an outline of the subject was compiled by the same author in January, 1919, for inclusion in a Tourist Department guide book, which, however, has not yet been published.

I regret that my ignorance of the existence of these articles caused the omission of any reference to Professor Taylor's researches in the Mt. Field district, and should, therefore, like the paragraph quoted above to be amended to read as follows:—

"The only previous literature on the subject of glaciation "in the National Park is a mention of the existence of traces "of glaciation in a paper, entitled 'Climatic Cycles,' published "in the American Geographical Review of December, 1919, "by Dr. Griffith Taylor, D.Sc., and a hitherto unpublished "account of the glacial features by the same author to be "incorporated in a handbook of the Park, the publication of "which is contemplated by the Government Tourist Depart-

"ment. We are also indebted to Dr. Taylor for a map and a "relief model of the area."

The general lack of knowledge on the subject of past glacial action in Tasmania, and the necessity of a general survey of our present information on the subject both recorded and unrecorded, is illustrated by a statement published by no less an authority than Professor Walter Howchin, F.G.S., of the University of Adelaide, in the Official Year Book of the Commonwealth of Australia, No. 13 of 1920, at page 1,135, of which the learned author says: "(c) "Glaciers of Tasmania—No expedition for the specific object "of investigating the Pleistocene Glacial remains has been "undertaken, but incidental observations bearing on the "subject have been made by several travellers who were "visiting the country in pursuit of other objects . . . . "etc."

The actual state of affairs is that this subject has been largely written upon by all our Government geologists and most of our outstanding geological observers. In the Papers and Proceedings of the Royal Society of Tasmania for 1916, Dr. W. N. Benson, at the end of his paper on the geological features of the Cradle Mountain district, at page 40, published a "Bibliography of Pleistocene Glaciation in Tasmania," containing 45 references. Of these, twelve (viz., references Nos. 8, 9, 10, 11, 12, 17, 25, 33, 35, 43, 44, and 45) are detailed and extended accounts of the glacial phenomena within the area described, the remainder being references to the occurrence of such phenomena. Also, it is far from the truth to suggest that these observations were made by "travellers who were visiting the country in pursuit of other "objects." Only nine of the references (viz. Nos. 4, 7, 14, 15, 24, 25, 28, 29, and 41) were written by gentlemen who were not domiciled Tasmanians. In the recently published R. M. Johnston Memorial volume one paper by the late Mr. Johnston on the Pleistocene Glacial Epoch extends over 80 pages.

For the sake of completeness, and for the benefit of anyone studying this subject, I should like to add the following references to Professor Benson's bibliography:—

10. 1893. R. M. Johnston. "The Glacial Epoch of Australasia," Proc. Roy. Soc. Tas., 1893, republished R. M. Johnston Memorial volume, 1921, pp. 16-96.

19a. 1894. E. J. Dunn. Proc. Roy. Soc. Vict. (new series), Vol. VI. (1894), pp. 133-138.

46. 1916. W. N. Benson. "Notes on the Geology of the Cradle Mountain District," Pap. and Proc. Roy. Soc. Tas, 1916, pp. 34-40.

47. 1918. Hartwell Conder. "The Tin Field of North Dundas," Geol. Surv. Tas. Bull. No. 26, pp. 8, 9, and 26.

48. 1918. A. McIntosh Reid. "The North Pieman, Huskisson, and Stirling Valley Mining Fields," Geol. Surv. Tas. Bull. No. 28, pp. 15-18.

49. 1919. A. McIntosh Reid. "The Mining Fields of Moina, Mt. Claude, and Lorinna," Geol. Surv. Tas. Bull. No. 29, pp. 10, 21, and 43.

50. 1919. A. McIntosh Reid. "The Mt. Pelion Mineral District," Geol. Surv. Tas. Bull. No. 30, pp. 14-17.

51. 1919. Griffith Taylor. "Climatic Cycles." American Geographical Review, Dec., 1919, pp. 292-3.

52. 1920. A. McIntosh Reid. "Osmiridium in Tasmania," Geol. Surv. Tas. Bull. No. 32, pp. 69, 83, and plans.

53. 1920. W. Howchin. "Past Glacial Action in Australia," Official Year Book of Comm. of Aust., No. 13, p. 1,133.

STUDIES IN TASMANIAN MAMMALS, LIVING AND EXTINCT.

No. VI.

CETACEAN REMAINS FROM THE FOSSIL BEDS AT WYNYARD.

By

H. H. Scott, Curator, Launceston Museum,

And

Clive Lord, Curator, Tasmanian Museum.

(Read 5th December, 1921.)

We desire to place on record a few notes relating to the discovery of certain Cetacean remains from the assumed Miocene beds at the Wynyard Cliffs, North-West Tasmania.

Our latest additions consist of parts of the embedded centra and processes of some twenty vertebræ, which in superficial osteology agree fairly closely with those of the modern *Globicephalus* whales, and depart, as equally, from such *Squalodont* remains as we have handled from this locality.

Early in the year 1914 Messrs. E. D. and R. N. Atkinson presented to the Launceston Museum a small slab of rock, much infiltrated with silicon, containing a fossil that was determined as the supra-orbital portion of a Delphinoid skull that had been stripped of its overlying maxillary wing, prior to its inclusion in the matrix. The donors, upon extended research, were able to unearth, at some distance from the first discovery, a piece of fossil bone that presented every appearance of being the missing maxillary wing, it having evidently been swept hither and thither upon the old Miocene beach until it eventually found a resting place.

These remains were plotted out in terms of modern Cetaceans and were found to agree in several points with

the Round Headed Dolphin, and in this connection the agreements noted were as follows:—

(1) The frontal bone was excavated for the reception of the coronoid process of the mandible. This character is retained in *Globicephalus* but not in *Delphinus* or *Tursiops* to any extent.

(2) The single vertebra and scrap of the mandible found with this skull also agree with *Globicephalus* as far as they were available for comparison, but their fragmentary nature made a close study quite impossible.

(3) Upon the assumption that the rest of the skull indicated parts of the frontal bone curving upwards to form the fronto-occipital ridge and a moiety of the posterior upper wall of the temporal fossa, with a forward extension to the maxillary region, the whole of the find was accounted for.

The recent acquisition by the Tasmanian Museum of some twenty vertebral remains, previously mentioned, seems to confirm the idea of these being related to a whale of *Globicephalus* class, and we provisionally record them as such.

At a future date we hope to give extended details, together with illustrations of the two discoveries. This paper must therefore be regarded as a preliminary recording note only. It is most unfortunate that both of the Atkinsons, father and son, have passed away without leaving any exact data as to the spots from which the fossils were obtained. The recently instituted Government protection of these fossil cliffs should prevent such situations arising in the future.

THE CONCAVE STONE IMPLEMENTS OF THF TASMANIAN ABORIGINES.

By George Horne, V.D., M.A., M.D., Ch.B.

Plates XXVI-XXVIII.

(Read 5th December, 1921.)

The following paper seeks to deal with these implements as they are found in Tasmania, and to institute a comparison with those found in S.E. Victoria.

This is the last part of Australia to be united to Tasmania, and here, if anywhere, resemblances should be found.

When we take into consideration the daily life of the aboriginal, a considerable part must have been spent in the making, smoothing, sharpening, and maintaining of his wooden weapons.

These were two in number—the spear and the throwing stick. All the secondary or finishing work on them was done with the concave stone implements.

DIFFERENT GROOVES FOR DIFFERENT PURPOSES.

Two sorts of grooves would, of course, be necessary, and two sorts are found for preparing these two weapons. There is the short semi-circular groove (Fig. 1a.), usually small in diameter. This was evidently for the smaller circumference of the spear or for the sharpening of points of either implement. Then there was the long hyperbolic curve (Fig. 2b.), which is, as a rule, larger and stouter. It appears to have been used in the earlier work on implements. (In my collection, this variety is the commoner form of the two in Tasmania.)

VARIETIES OF GROOVES.

1. *The Worked Groove* (Fig. 2a.).—The chipped markings along the edge show plainly that the groove has been worked; and this is the commonest form of Tasmanian concave implements.

In S.E. Victoria one finds the working developed further into crenulations. These must have acted like so many teeth, and would have been most effective in the first cutting action when getting the wooden implements into shape. I have not seen this form amongst Tasmanian specimens.

2. *The Smooth Groove* (Fig. 3).—This is relatively rare

Fig 1A.

Fig. 1B.

Fig. 2A.

Fig. 4.

Fig. 2B.

Fig. 5A.

Fig. 3.

Fig. 5B.

in Tasmania, but is very common in S.E. Victoria. It is made by the pressure of a rounded wooden weapon on the thin edge of the stone.

This concave implement is often also concave in transverse section, and is like the covers of a closed book which stand out beyond the leaves. Gradually friction reduces these sharp edges (which are quite thin, and in this also resemble the covers of a book). Generally, however, a shadow can be seen running longitudinally along the face of the groove, which shows that at first there is a part untouched by friction.

The absence of any chipping or irregularity would impart smoothness to the weapon being worked. The sharp, thin outside edges are the best possible thing for scraping action.

3. *The Channel Groove* (Fig. 4) is the third variety, and consists of a concave gutter sometimes 24 mm. long (13 mm. is the longest noted amongst Tasmanians). This gutter frequently dips down at its outside edge, *i.e.*, it is bevelled at the gutter's end. This bevelling would be made by rubbing the implement on the spear with long sweeps, when its edge would turn over to a slight extent.

A variant of the channel groove is found in the *underneath groove* (Fig. 5). In this the groove, instead of being made on the narrow surface of the stone, is upon its under surface.

The Tasmanian concaves differ from the Victorian chiefly in the coarseness, strength, and power of the former and the delicacy and fineness common in the latter.

The Victorian as a rule (though not always) made his concave scraper out of a flake that was chipped first, and had, therefore, always a suitable edge for making this groove upon.

METHODS OF USE.

Amongst the Australians a common method is the (1) *two-handed* or spokeshave method as in the illustration of the Aluritja man (Fig. 8).

For this photograph I have to thank Dr. Basedow, from his *Australian Tribes*. This method was sometimes used by the Tasmanians as is seen in Fig. 2b., which shows two thumb-marks for gripping the spokeshave. The Victorian often made a long flake first, and chipped marks on it subsequently for steadying fingers or thumbs. They would then break in the concave grooves which completed the spokeshave.

Sometimes the position of the groove tells that it was for (2) *one-handed* use. The concave is in this case at the end of a stone which may be quite long, or it may be near the end at one side, or it is on such a round thick stone as appears improbable for a spokeshave.

The channel grooves appear to have been used by the (3) *overhand* grip, as in the illustration of the Wonkanguru man (Fig. 9), for which I have to thank Mr. Aiston. The man is here using a flat smoother on a boomerang, but the method of employment is the same.

OTHER IMPLEMENTS USED.

The Tasmanians frequently made, upon a straight edge, a curved excrescence or a sharp point. The protuberance was chipped all round, or, if a point, on both sides. With its use this article does not deal. The angle, where this curve or point joined the straight edge, was often used to form a concave scraper.

If both sides of the curve or point were so used, a (1) *"duck-bill"* (Ling Roth) was made (Fig. 6).

The illustration shows a chalcedony specimen from Lisdillon, near Little Swanport, where one angle of the chipped curve has been so employed.

Just as other implements were often used as concave scrapers in Australia, the Tasmanian would also pick up the first stone to hand if he sought to plane down his throwing stick, or to put a point on his spear. For him the (2) *scraper* with its thinner edge and especially with its chipped margin would be particularly suitable; therefore, it is this implement that was most frequently used.

The comparatively (3) *thin knives* of the Tasmanians are made quite readily into concave scrapers, and, although this is not seen as often as it is North of Bass Straits, yet relatively they are quite as frequent. The Victorians frequently used the little "chipped-back knives" (Etheridge) as sharpening implements, and even the minute, round, chipped scrapers (6 mm. in diameter) are sometimes grooved for that purpose.

The disc-shaped scraper (4), which has one flat side (Fig. 1a and b), and the other side either flattened or in a ridge, or conical, is in 16 per cent. of my cases made into a concave scraper. Mr. Clive Lord draws my attention to the fact that dents in its edge are frequently worked in concave implements. It is singular that a similar employment by the Victorians is not noted. Out of 60 (not selected) specimens, not one had been so employed.

Fig. 6.

Fig. 7.

Fig. 6. Chalcedony specimen from Lisdillon.

Fig. 7. Specimen from Melton Mowbray.

PART OF THE STONE USED.

The chipped stones that are used as implements have, more or less, a definite shape. They have the one side more or less flat, and the other side raised, tending to form a pent house, ridge, keel, or cone. Mr. Scott, whose brother lived long amongst Tasmanian aboriginals, was the first (P. & P. R.S. Tas., 1873) to point out that the flat side was always used with the thumb upon it. The keeled or conical side supported the fingers. On the edge of this finger side was the chipping. The concave groove, especially when it was worked, was never straight across the stone. It was always on the same side as the chipping and sloped up from the margin on to this finger-side. This holds good for the first groove that was made in an implement, but frequently two grooves were made. This was, generally, in stones that were more or less flat on both sides. Here both sides were treated as if they could be thumb-sides, and the second groove was therefore cut on the opposite side of the stone to the first groove.

It has been asserted (Noetling, P. & P. R.S. Tas., 1909) that this was an accident, and arose from a mistake on the part of the native. However, my investigations over a small group of concave scrapers show that in 84 per cent. of cases (not including duck-bills) the grooves are on opposite sides of the stone, and only in 16 per cent. upon the same side. In cases where they are chipped, the chipping is on the opposite side, but in the concave and also on the stone around. Apparently the groove which was first made was placed opposite that side which was most plainly the thumb-side.

It is impossible to say why this particular device to work on opposite sides of the stone existed in the Tasmanian. A somewhat similar habit exists in Australians, not indeed in concave scrapers, but in those irregular chunks of stone used as scrapers.

The concave scrapers of S.E. Victoria, in picking up at random 100 double-grooved stones, I find to be in 26 per cent. on opposite sides, whilst 74 per cent. are on the same side. Why this should be it is difficult to say. One might hazard a guess that the Australian frequently used his concave scraper with two hands, that is, as a spokeshave, and he therefore from the start made a tool that would work in that way.

NUMBER OF GROOVES.

The number of grooves that may be made in any stone of course varies; but, as one might guess from the casual

habits of the native, one groove was made, it was used, and the stone then dropped. The following table was made from a random 100 concave scrapers:—

Concave scrapers with	1 groove	44	per cent.
	2 grooves ..	20	„ „
	3 or more grooves ..	36	„ „

As many as six grooves I have found on one stone, but such a large number is uncommon.

Amongst the Victorians large numbers of the smooth grooves are the rule, whereas almost invariably single concaves are found where a pebble is used, and worked grooves are either single or not numerous.

MATERIAL.

Any material, just as any implement, may serve the Tasmanian in making a concave scraper; but by far the commonest in use is the blue-black metamorphic mudstone, called hornstone by some writers.

This stone has the peculiarity that its surface, in certain conditions, alters. It changes with decomposition to a light buff colour, but it still remains hard and its outlines are still sharp. It is not a real patina, but a decomposition of the rock. Some implements, that I have, are heavily thus patinated, but have other concave grooves worked in them that are blue-black and sharp (Fig. 7).

The difference between the age of the grooves covered with patina and those grooves with no patina would be interesting.

Unfortunately, the patina is acquired in varying times according to the moisture, etc.

All one can say is that some considerable time has elapsed since the first chips were made. How long we can guess at, but a guess it must remain.

EXPLANATION OF PLATES.

Plate XXVI.

Fig 1A.	Fig. 2B.	Fig. 2A.	Fig. 2B.
Fig. 3.	Fig. 4.	Fig. 5A.	Fig. 5B.

Fig. 8 Aluritja man using two-handed spokeshave. (Illustration from Dr. Basedow's *Australian Tribes.*)

Fig. 9. Wonkanguru man using flat smoother. (From photograph by Mr. Aiston.)

PLATE XXVII.

Fig. 6. Fig. 7

Fig. 6.

Chalcedony specimen from Lisdillon, East Coast.

Fig. 7.

Specimen from Melton Mowbray.

PLATE XXVIII.

Fig. 8.

Aluritja man using two-handed spokeshave. (Illustration from Dr. Basedow's *Australian Tribes.*)

Fig. 9.

Wonkanguru man using flat smoother. (From photograph by Mr. Aiston.)

SOME GEOGRAPHICAL NOTES ON A MODEL OF THE NATIONAL PARK AT MT. FIELD, TASMANIA.

By Professor Griffith Taylor, D.Sc., B.E., B.A., F.G.S., F.R.G.S.

Plates XXIX., XXX., and Five Text Figures.

(Read 5th December, 1921.)

Early in February, 1919, I had the pleasure of visiting the Tasmanian National Park with a party organised by the Hon. Secretary to the Park Board. The whole journey was filled with interest to the geographer, especially as my suspicions of a glacial topography were abundantly verified by the fine examples of cirques, moraines, erratics, and glacial lakes which I identified on the plateau.

I collected topographic data sufficient to construct a rough contour map (Plate XXIX.), using the reconnaissance survey of Mr. Propsting and others as a basis. From this on my return I constructed the model which is illustrated in Plate XXX. Owing to the pressure of other research, I was unable to complete a memoir on the glacial features, and these have since been worked out with great care and success by Mr. A. N. Lewis, *M.C.* (1)

There are a few aspects of the problem which do not appear in his lengthy memoir, and I feel that the geographical literature of Tasmania is so scanty that these brief notes may not be out of place.

The most striking feature of the region perhaps is the marked parallelism of the valleys. The Plateau is so dissected that in plan it is somewhat like a gridiron (see Fig. 1), with three or four main ridges all trending north-west to south-east. Almost the whole area consists of one geological formation, a medium-grained dolerite or diabase, so that we are not concerned here with dip or strike topography. Jointing is a more probable cause, and a reference to Tasmania as a whole shows that the major tectonic features have the same direction. I have elsewhere (p. 176, "Australian Environment," 1918) drawn attention to this "grain"; which is well seen in the three main lines of weakness in the island. These are the Tamar-Macquarie lineament, the Lake St. Clair-Derwent lineament and the Macquarie Harbour-Gordon lineament. (See Fig 1.)

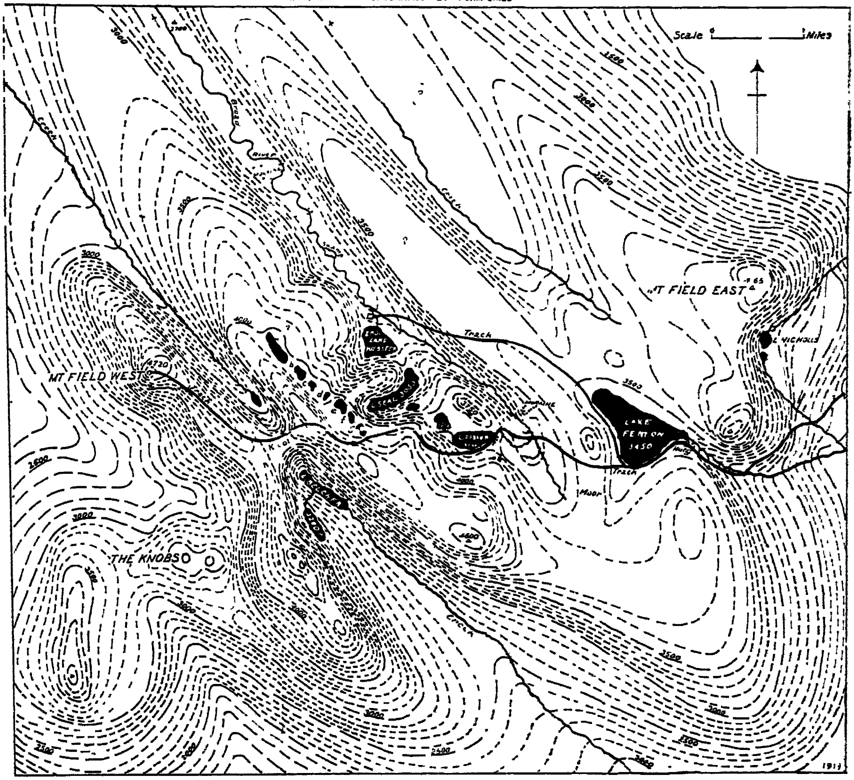
(1) P. & P. Roy. Soc. Tas., 1921, pp. 16-36.

SKETCH MAP

MOUNT FIELD. NATIONAL PARK. TASMANIA

BY DR GRIFFITH TAYLOR BE. BA. FGS. FRGS

APPROXIMATE TOPOGRAPHY BY FORM-LINES



NOTE.—Lakes shown black, thick lines are main tracks. Form-lines only approximate.

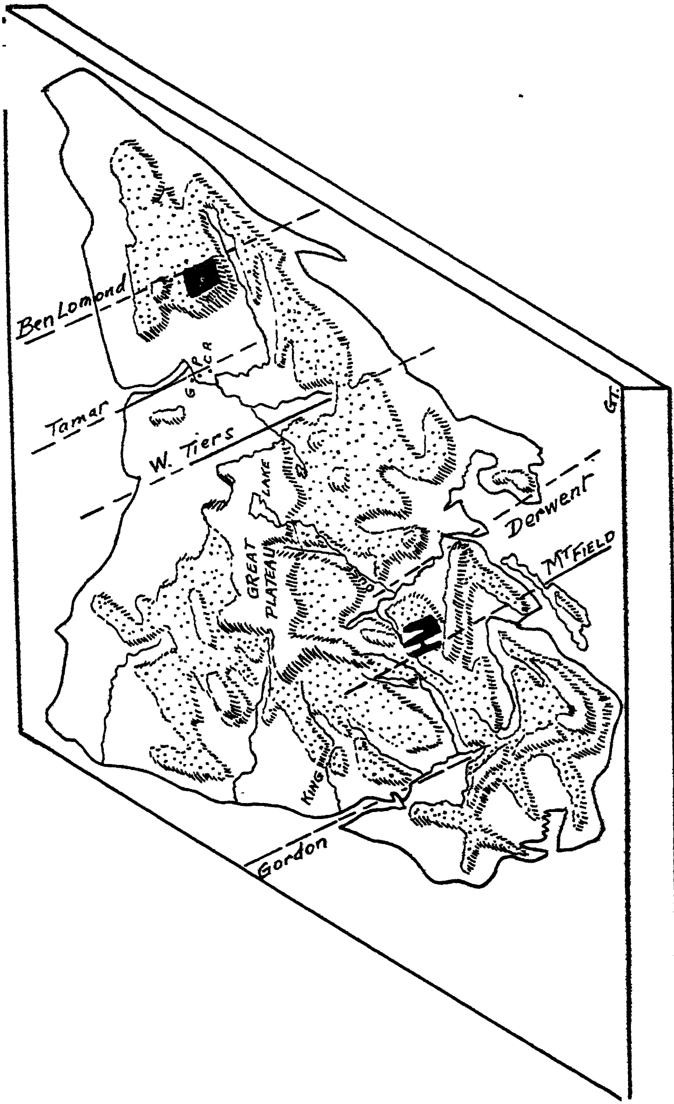


Fig. 1.—Block diagram illustrating some of the main "lineaments" of Tasmania. The Mount Field Plateau is the black "gridiron" in the south. Ben Lomond Plateau is the black rectangle in the north-east. The Gorge, Punchbowl, and Corra Lynn at Launceston are indicated. The 1,000 foot and 3,000 foot contours are shown by the dotted and a higher plain "layers."

The trellis-work drainage of the summit of Ben Lomond(2) seems to show that this diabase plateau is dissected along a similar series of fault-planes running north-west to south-east. There is here, however, also a set of cross-faults, and together they have determined the rectangular shape of the top of the plateau.

My belief is that the whole island is dominated by fault-blocks and fault-planes, some of which are no doubt later than the intrusion of these diabase sills. Hence the Mount Field Plateau offered unequal resistance to the agents of erosion, with the result stated. This theory must of course be tested further in the field.

The second problem concerns the agents which have

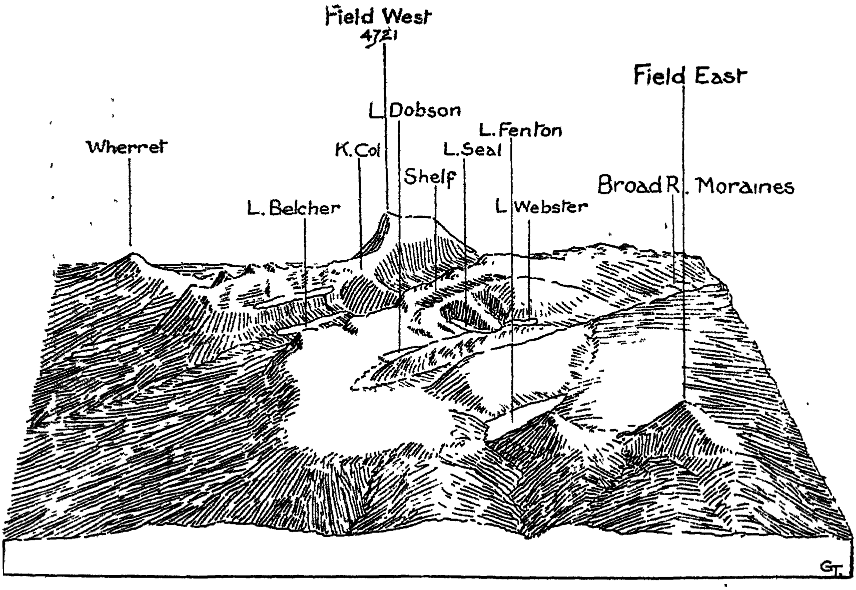
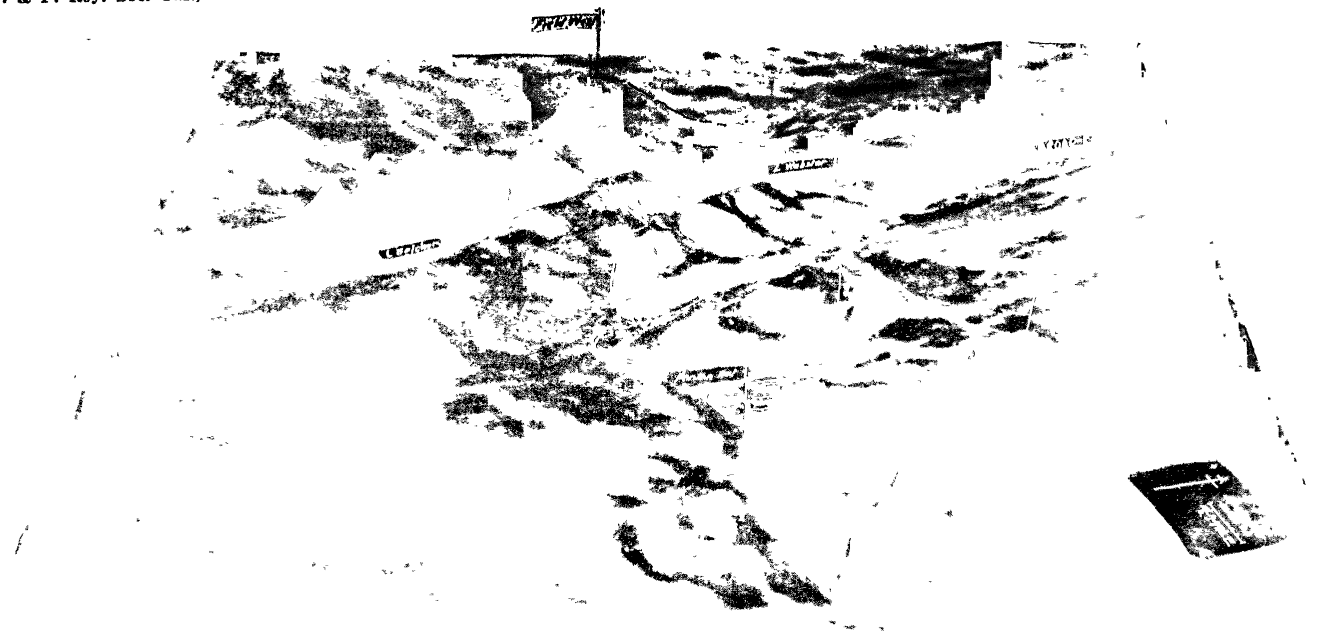


Fig. 2.—Block diagram of the Plateau looking west. The parallel arrangement of the valleys and lakes is apparent. Notice the "shelf" of tarns, the cirque of Lake Seal, and "K" Col. A glacier 5 miles long descended the Broad River Valley.

given rise to the remarkable topography (see Fig. 2). We have here offered to us the same difficulties as are met with so generally in the elevated portions of the temperate zone. The special facies of the region is due to glacial

(2) P. & P. Roy. Soc. Tas., 1913. Map by Colonel Legge.



oto. by Beattie.)

Model of the Mount Field Plateau—National Park, Tasmania.
A Key to the model appears in fig. 2.

erosion; but how much erosion by ordinary streams preceded the advent of the Ice Age? And further, was the glacial erosion due to glacier *planation* (*i.e.*, by the rasping and plucking due to debris cemented on the sole of the glacier) or to the method which has been termed *"nivation"*?

Evidence as to the great amount of erosion accomplished since the last period of uplift is obvious throughout Tasmania. The gorge of the Ouse is cut down 1,200 feet, while the King River canyon is even more striking. A better-known example lies in the suburbs of Launceston, and offers a wonderful study to the Tasmanian geographer. Here the South Esk enters the Tamar estuary through a most picturesque notch giving the clearest evidence of late uplift; though later subsidence(3) has drowned the mouth of the gorge. Probably Corra Lynn gorge and the Punchbowl, a few miles to the south-east, are due to the same differential movement between the Tamar estuary and the environs of Launceston. The positions of these most interesting examples appear on Figure 1.

We may therefore, I think, postulate a considerable amount of erosion in the pre-glacial period, giving rise to valleys, perhaps 500 feet deep, where now flow the Broad River and the creeks draining north and south from K Col, through Lake Hayes and Lake Belcher. These pre-glacial valleys would be of a juvenile type with V cross sections, and the thalweg would fall rapidly in the first mile of each stream. (See Fig. 3.)

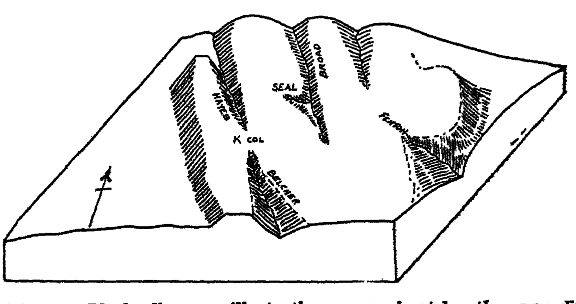


Fig. 3.—Block diagram illustrating approximately the pre-glacial drainage of the Plateau.

It will be seen, therefore, that the striking cirque valleys of Lake Hayes, Lake Belcher, and Lake Seal were originally

(3) Daly would explain this drowning as due to the melting of the world's ice caps after the Ice Age.

not unlike the steep valley which leads from Fenton Hut down the outer slope of the Plateau towards Russell Falls. There was, therefore, a good deal of material to be removed during the Ice Ages before these valleys developed the characteristic cirque-heads of to-day.

In each of these three typical cases the cirque has a maximum wall of about 1,000 feet, lying approximately between the 3,000 and 4,000 feet contours.

It is further to be noted that these cirques lie largely on the sheltered easterly aspect of the ridges, so that they are protected from the hot afternoon sun.

To understand the way in which the ice has eroded these valleys we must, I think, further consider two aspects of the problem. Firstly, the alimentation of the glaciers; and secondly, the life history of the latter. We shall then, I believe, see that nivation probably played a more important part than planation in carving out the main cirques. This type of erosion also helps to explain the interesting shelf-tarns above Lake Seal, and the unusual position of Lake Belton "perched" above Lake Belcher.

The snow-fields nourishing the glaciers of the plateau must have been very circumscribed. The collecting ground for the Hayes and Belcher glaciers was the original K Col and the adjacent narrow ridges. It seems to me unlikely that the Belcher glacier resulting from this meagre snowfield had sufficient power to gouge out a bowl-shaped hollow *right at its head* to the depth of one thousand feet. The same objection applies to the Hayes glacier, and to a lesser degree to the Seal glacier.

On the other hand, if we adopt the principle of *nivation,* as developed by the Americans, Matthes, Johnson, and Hobbs, the process of erosion becomes much more intelligible. In nivation the alternating freezing and thawing of water in the interstices of the rocks is the prime agent of disintegration. The glacier plays a somewhat passive part in the erosion, but supplies much of the water for the nivation by the melting of its periphery. Its surface, however, acts as a vehicle which very slowly carries away debris to the lower end. The thaw-water streams at the side of the glacier also are of great importance in eating down the rock edges of the valley. The glacier also acts something like the scour-wall at a river mouth which directs the removal of debris. (See the paper on Antarctic Glaciology by the writer—Geogr. Jnl., 1914, p. 562.)

In my brief report(4) on the glaciology which I made in February, 1919, I wrote as follows:—

> "In the early days of the Ice Age a great drift of "snow occupied a shallow valley where now is Lake Seal. "Freezing and thawing took place continually around "this snow-drift, and broke down the structure around "the drift. Small streams surrounded the drift, and not "only supplied the ice wedges, but carried away some of "the debris. The sapping extended outward by slow "degrees as the snow-drift increased, and gradually a "flat valley was eroded, much like the embryo cirque on "the 4,300-foot level above (and south of) Lake Seal. "(See Fig. 5 at A.) The deepening process would ad- "vance into the hill at the foot of the snow-drift and "would be especially strong during the dwindlnig of the "ice-slab (into which the snow would soon be converted) "as the Ice Age passed away."

It is important to realise that the oncoming and waning of the Ice Age were both gradual. Hence the controls determining the erosion varied more or less continuously. The major control was, of course, the temperature; and the point is not sufficiently stressed in glacial literature, that there is an optimum temperature as far as frost-action is concerned. It is obviously near the melting point of ice, and probably from 32 deg. to 35 deg. F. (or around 34 deg. F.) is about the most favourable temperature. One of the most striking results of my Antarctic investigations was to find that the temperature in the Antarctic is too cold for the maximum glacial erosion. There is infinitely more of this erosion going on in New Zealand than in latitude 78 deg. South.

We must therefore imagine this layer of favourable temperature slowly settling down on to the plateau as the Ice Age is ushered in. At present the temperature layer of 34 deg. F. lies at 6,000 feet above sea level and about 3,000 feet above Lake Seal. Here we may assume an average annual temperature of about 44 deg. F. at the present time. (See Fig. 4.)

If now we imagine a cooling of about 10 deg. F. at the maximum of the Ice Age, this "nivation-layer," as we may term it, will descend to the level of Lake Seal, and the maximum amount of frost action will occur at this level. Above

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(4) A report prepared for the Tasmanian Government Tourist Bureau.

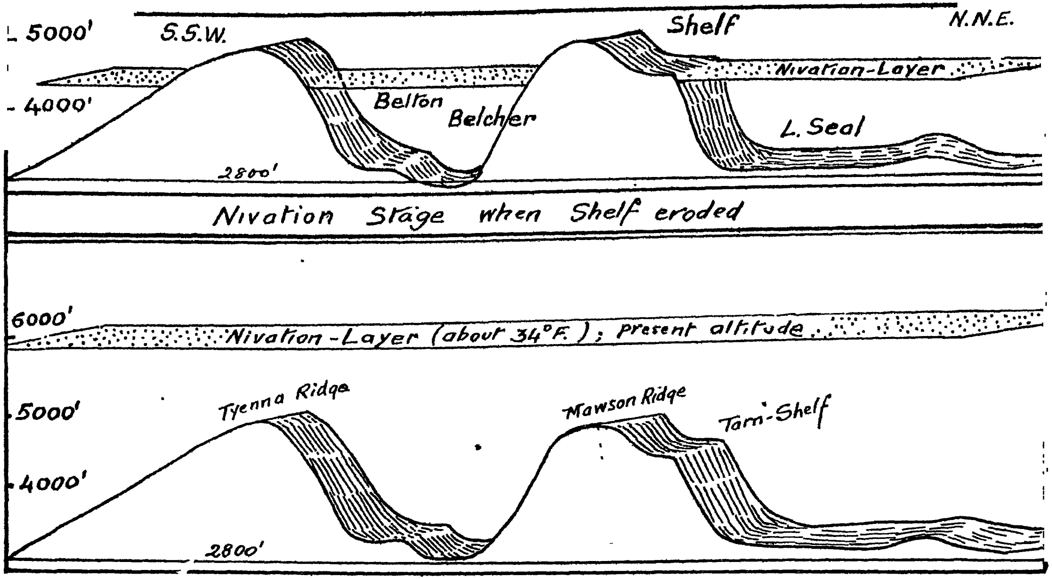

Fig. 4.—Block diagrams showing the movements of the layer of maximum sapping ("nivation-layer"). Upper figure, in Ice Age, when 4,300 feet above sea level. Lower figure, at present time. At maximum of Ice Age it descended to 2,800 feet.

this level the temperature will be somewhat too cold for the maximum effect, and below this level it will be too warm for ice to form.

We know that there were colder and warmer stages during the Pleistocene Ice Ages. This implies that the nivation-layer halted at various elevations in its descent from and ascent to its present elevation of 6,000 feet above sea level. I imagine that we have evidence of two such phases in the topography of the Plateau. At the maximum cold period the layer was at its lowest; and the low-level cirques of Lakes Seal, Hayes, and Belcher were cut out while the great Mount Field glacier moved down the river valley for some five miles as the beautiful moraine crescents (5) clearly show. At this period the edges of the Broad River Valley were "cleaned out" and the cross-section converted from a V into the catenary curve of the glacial type. All the lower moraines were laid down also at this phase. Two well-marked halts are indicated however by the grouping of the moraines, above and below the two enormous erratics in Broad Valley (which I learn from the paper by Mr. Lewis have been named after myself). This stage would be indicated in Figure 4 if we imagine the nivation-layer at the lowest level in the section.

The seven tarns named after Johnston and Newdegate lie on a shelf (see Figs. 4 and 5) whose origin can best be explained in a similar fashion, I think. They are at an elevation of 4,300 feet, or 1,200 feet above the floors of the cirques described previously. The shelf is about one mile long and varies in width from 80 yards in the south to a quarter of a mile at the somewhat lower northern end. The whole shelf is jewelled with rocky tarns lying in the hollows between rounded rock hummocks whose surface has certainly been smoothed by ice action. Their most striking feature, however, is the way in which some of the lakelets have two openings, one passing *along* the shelf to the north, and the other opening directly *over* the great thousand-feet cliff. Large erratics perch precariously on sloping platforms just as they were dumped by the ice. All this indicates that no long interval has elapsed since the topography was initiated, for the longitudinal drainage of the seven tarns must suffer capture in the near future by the streams flowing directly over the edge.

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(5) These were, I believe, first identified on February 3rd. 1919. See my brief report in American Geographical Review, December, 1919.

Fig. 5.—Sketch looking north-east over the tarns on the "shelf" above Lake Seal, showing the thousand feet of drop to Lake Seal. On the right at A is an immature cirque.

There are two possible explanaticns of this unusual shelf with its rock-tarns. One involves the filling of the whole Broad Valley with ice, so that the lateral drainage flowed to the ncrth along the position of this shelf and so cut a notch between the glacier and the containing ridge to the west. This is not well supported by the field evidence, though it accounts for the shelf sloping to the ncrth.

The mcre plausible explanation involves the nivation-layer which I have described above. I imagine that for some long pericd this layer with a temperature around 34 deg. F. halted at the 4,300 feet level, possibly both in the advancing and retreating hemi-cycles of the Ice Age. (See Fig. 4 above.) The shelf was favourably situated for collecting snow, which was not readily removed by the sun from its sheltered position. A series of cirques were sapped out in the course of time, and these became apposed sideways in much the same fashion as Nussbaum has described in the Swiss Alps.(6)

A shelf is thus produced by the sapping action of seven adjacent cirques. The ice-slabs are competent to carry the erratics to the positions noted, and also to round the rocks forming the rim cf the shelf. Since a cirque glacier "*burrows" into the hill* (as Hobbs has shown in his "Characteristics of Existing Glaciers") rather than erodes the valley under its snout, we see why the edge of the shelf remains almost entirely unaffected by the shelf glaciers.

The evolution of Lake Belton, perched some 300 feet up the side of the Lake Belcher Valley, may be partly explained in a similar fashion, but this demands much more field work than I was able to give to this locality.

It is in the hope that these brief notes will stimulate local interest in the innumerable geographical problems of Tasmania that I have written the paper.

LIST OF ILLUSTRATIONS.

PLATE XXIX.

Sketch survey of the Park. The form-lines are approximately correct near the routes marked, but are only filled in from sketches, etc., elsewhere.

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(6) Die Taler der Schweizer-Alpen; Berne, 1910.

Plate XXX.

Model of Mt. Field Plateau, National Park, Tasmania. A key to the model appears in Text fig. 2. (Photo. by J. W. Beattie.)

Text Figures.

ROYAL SOCIETY OF TASMANIA

ABSTRACT OF PROCEEDINGS

1921

14th March, 1921.

Annual Meeting.

The Annual Meeting was held at the Museum on 14th of March, 1921, Sir N. E. Lewis, K.C.M.G., presiding.

The Annual Report and Statement of Accounts were read and adopted.

The following were elected as Members of the Council:— Dr. A. H. Clarke, Dr. W. L. Crowther, Rt. Rev. Dr. R. S. Hay, Messrs. W. H. Clemes, W. H. Cummins, J. A. Johnson, L. Rodway, and Major L. F. Giblin.

Mr. R. A. Black was appointed Hon. Auditor.

Paper.

Nototheria and Allied Animals. By H. H. Scott and Clive Lord.

Illustrated Lecture.

Early Hobart. By L. Rodway, C.M.G.

Conversazione.

After the business of the meeting was concluded an adjournment was made to the Art Gallery, where a Conversazione was held.

11th April, 1921.

The Monthly Meeting was held at the Museum on 11th April, Mr. L. Rodway, C.M.G., presiding.

Mr. J. Moore Robinson was elected a Member of the Council.

Lecture.

"Education in Fetters." By S. R. Dickinson, M.A.

9th MAY, 1921.

The Monthly Meeting was held at the Museum on 9th May, His Excellency Sir W. L. Allardyce, K.C.M.G., presiding.

Mr. Clive Lord exhibited a series of fossils, including marsupial bones, which he had recently obtained from the Mole Creek Caves.

Papers.

"The Native Feeding Grounds at Little Swanport, East Coast." By W. L. Crowther, D.S.O., M.B.

"The Historical Records of Tasmania." By J. Moore Robinson, F.R.G.S.

13th JUNE, 1921.

The Monthly Meeting was held at the Museum on 13th June, Mr. L. Rodway, C.M.G., presiding.

Papers.

"New Species of Fossil Mollusca."* By W. L. May.

"Studies in Tasmanian Mammals." *Zaglossus harrissoni*, sp. nov." By H. H. Scott and Clive Lord.

"The Fossil Remains at Mole Creek." By H. H. Scott and Clive Lord.

Lecture.

"The Coastal Camps of the Australian Aborigines." By George Horne, M.A., M.D.

11th JULY, 1921.

The Monthly Meeting was held at the Museum on 11th July, Mr. L. Rodway, C.M.G., presiding.

Papers.

"Description of a New Species of *Loricella*." By Edwin Ashby, F.L.S.

"The Glacial Remains in the National Park." By A. N. Lewis, M.C.

"Australian *Bombyliidæ* and *Cyrtidæ*." By G. H. Hardy.

Illustrated Lecture.

"Fiji." By His Excellency Sir W. L. Allardyce, K.C.M.G.

8th August, 1921.

The Monthly Meeting was held at the Museum on 8th August, Mr. L. Rodway, C.M.G., presiding.

Papers.

"The completion of the General Magnetic Survey of Australia by the Carnegie Institution of Washington." By Captain Edward Kidson, O.B.E., M.Sc.

"Skeletons of the Monotremes in the Collections of the Army Medical Museum at Washington." By Dr. R. W. Shufeldt, C.M.Z.S.

"The Progress cf Geological Research in Tasmania since 1902." By Loftus Hills, M.B.E., M.Sc.

"France and Australia—The 'Prise de Possession.' " By Thomas Dunbabin, M.A.

"Tasmanian State Records." By J. Moore Robinson, F.R.G.S.

Illustrated Lecture.

"The Geology of the National Park." By A. N. Lewis, M.C.

19th September, 1921.

The Monthly Meeting was held at the Museum on 19th September, Mr. L. Rodway, C.M.G., presiding.

Paper.

Jungermannia stygia. By H. W. Pearson, A.L.S.

Illustrated Lecture.

"The Application of Science to Warfare on the Western Front." By Loftus Hills, M.B.E., M.Sc.

10th October, 1921.

The Monthly Meeting was held at the Society's Room, Museum, on 10th Octcber, His Excellency Sir W. L. Allardyce, K.C.M.G., presiding.

Papers.

"On *Polyporus pulcherrimus.*" By L. Rodway, C.M.G.

"Bryophyte Notes." By W. A. Weymouth and L. Rodway, C.M.G.

"Description of Two Tasmanian Aboriginal Crania." By W. L. Crowther, D.S.O., M.B., and Clive Lord.

14th NOVEMBER, 1921.

The Monthly Meeting was held at the Museum on 14th November, Mr. L. Rodway, C.M.G., presiding.

Paper.

"An Additional Note to a Preliminary Survey of the Glacial Remains preserved in the National Park of Tasmania." By A. N. Lewis, M.C.

Illustrated Lecture.

"The Structure of the Atom." By Dr. L. McAulay.

5th DECEMBER, 1921.

A Meeting was held at the Museum on December 5th, Dr. A. H. Clarke presiding.

Papers.

"The Concave Stone Implements of the Tasmanian Aborigines." By George Horne, V.D., M.A., M.D., Ch. B.

"Cetacean Remains from the Fossil Beds at Wynyard." By H. H. Scott and Clive Lord.

"Some Geographical Notes on a Model of the National Park at Mount Field." By Professor Griffith Taylor, D.Sc., B.E., B.A., F.G.S., F.R.G.S.

ANNUAL REPORT
1921

The Royal Society of Tasmania

Patron:
HIS MAJESTY THE KING.

President:
HIS EXCELLENCY THE GOVERNOR OF TASMANIA
(SIR W. L. ALLARDYCE, K.C.M.G.)

Vice-Presidents:
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A. H. CLARKE, M.R.C.S., L.R.C.P.

Council:
(Elected March, 1921).

A. H. CLARKE, M.R.C.S., L.R.C.P. (*Chairman*)
W. H. CLEMES, B A., B.Sc.
W. E. L. CROWTHER, D.S.O., M.B.
W. H. CUMMINS, A.I.A.C.
L. F. GIBLIN, D.S.O.
RT. REV. R. S. HAY, D.D.
J. A. JOHNSON, M.A.
L. RODWAY, C.M.G.
J. MOORE-ROBINSON, F.R.G.S. (elected April, 1921)

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L. RODWAY.

Editor:
CLIVE LORD

Auditor:
R. A. BLACK.

Secretary and Librarian:
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Spencer, Sir W. Baldwin, K.C.M.G., M.A., D.Sc., Litt.D., F.R.S. Melbourne.

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"C," Corresponding Member.

"L," Member who has compounded subscriptions for life.

* Member who has contributed a Paper read before the Society.

† Member who has been elected a member of the Council.

Year of Election.		
1916		Ansell, M. M., B.A. The University, Hobart.
1920		Arnold, T. P. 37 Cromwell Street, Battery Point.
1921		Atkinson, C. W., M.A., L.D. 117 St. John Street, Launceston.
1918	L	Avery, J. 52 Southerland Road, Annandale, Melbourne, Victoria.
1921		Allen, D. V., B.Sc. Principal Launceston Technical College.
1908	L	Baker, Henry D. C/o American Consulate, Hobart.
1921		Baker, H. S., LL.M., M.A. York Street, Sandy Bay.
1887		Barclay, David. 143 Hampden Road, Hobart.
1921		Barr, J. Stoddart, M.D., Glas. Lower Sandy Bay.
1890		*Beattie, J. W. 1 Mt. Stuart Road, Hobart.
1918		Bellamy, Herbert, City Engineer. Town Hall, Hobart.
1901	C	Benham, W. B., M.A., D.Sc., F.R.S., F.Z.S. Professor of Biolcgy, University of Otago, Dunedin, N.Z.
1903		Bennett, W. H. Ashby, Ross.
1918		Bennison, E. A. Napoleon Street, Battery Point.

Year of Election.		
1921		Bertouch, V. Von. Wellington Square Practising School, Launceston.
1920		Bernacchi, A. G. D. Maria Island.
1921		Bethune, Rev. J. W., B.A. Church Grammar School, Launceston.
1921		Birchall, J. A. 118 Brisbane Street, Launceston.
1912		*Black, R. A. Chief Clerk, Department of Agriculture.
1909		*Blackman, A. E. Franklin.
1920		Blaikie, T. W. Practising School, Elizabeth Street, Hobart.
1918		Bowling, J. "Barrington," Tower Road, New Town.
1892	C	Bragg, W. H., M.A., F.R.S. Professor of Physics in the University College, London.
1920		Brett, R. L., B.Sc. 160 Macquarie Street, Hobart.
1917		Brettingham-Moore, E., M.B., Ch.M. Macquarie Street.
1911		Brooks, G. V. Director of Education, Education Department, Hobart.
1921		Brown, Mrs. Justin. 10 Welman Street, Launceston.
1907		Brownell, F. L. "Leura," Main Road, Moonah.
1921		Bruce, L. S. Tourist Bureau, Launceston.
1918		Bryer, J. R. Taroona.
1918		Burbury, Alfred. "Glen Morey," Antill Ponds.
1918		Burbury, Frederick. "Holly Park," Parattah.
1919		Burbury, Charles. "Inglewood," Andover.
1919		Burbury, Gerald. "Syndal," Ross.
1919		Burbury, T. J. "Park Farm," Jericho.
1920		Burdon, R. S., B.Sc. The University of Tasmania.
1909		†*Butler, W. F. D., B.A., M.Sc., LL.B. Bishop Street, New Town.
1921		Butler, Rev. W. Corly. The Parsonage, Melville Street.
1917		Butters, J. H. Chief Engineer and Manager State Hydro-Electric Department, Hobart.
1921		Camm, Dr. Carlyle. George Street, Launceston.
1920		Cane, F. B. 90 High Street, Sandy Bay.
1920		Canning, R. W. The University, Hobart.
1919		Chapman, A. D. 105 Macquarie Street.

Year of Election.		
1912		Chapman, J. R. Holbrook Place, Hobart.
1901	C	Chapman, R. W., M.A., B.C.E. Elder Professor of Mathematics and Mechanics in the University of Adelaide. The University, Adelaide.
1913		Chepmell. C. H. D. Clerk of Legislative Council, Hobart.
1920		Clarke, W. I., M.B. Macquarie Street, Hobart.
1896		†*Clarke, A. H., M.R.C.S., L.R.C.P. St. Helens, Tasmania.
1918		Clarke, T. W. H. Quorn Hall, Campbell Town.
1887		†Clemes, Samuel. Principal Leslie House. Clare Street, New Town.
1910		†*Clemes, W. H., B.A., B.Sc. Leslie House School, New Town.
1917		Copland, D. B., M.A. Lecturer in History and Economics. The University, Hobart.
1920		Cranstoun, Mrs. F. A. 6 Gregory Street, Sandy Bay.
1917		Cullen, Rev. John. Macquarie Street, Hobart.
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1919		†*Crowther, W. L., M.B., D.S.O. Macquarie Street, Hobart.
1919		Davis, H. Warlow, C.E. Abermere, Mt. Stuart.
1908		†Dechaineux, Lucien. Principal of Technical School, Hobart.
1903		Delany, Most Rev. Patrick. Archbishop of Hobart. 99 Barrack Street.
1892	C.	Dendy, A., D.Sc., F.R.S., F.L.S. Professor of Zoology in the University of London (King's College). "Vale Lodge," Hampstead, London, N.W.
1921		Douglas, O. Gordon. 27 Patterson Street, Launceston.
1921		Dryden, M. S. 13 Hillside Crescent, Launceston.
1921		Eberhard, E. C. Charles Street, Launceston.
1919		Elliott, E. A., M.B. Macquarie Street, Hobart.
1918		Ellis, F. Education Department, Hobart.
1921		Elms, E. A. Post Office, Launceston.
1913		Erwin, H. D., B.A. Christ's College, Hobart.
1921		Emmett, E. T. Director Tasmanian Government Tourist Bureau, Hobart.

Year of Election.

1918 Evans, L. Acting Director of Agriculture, Hobart.

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1902 Finlay, W. A. 11 Secheron Road, Hobart.

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1918 Fletcher, C. E. Education Department, Hobart.

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1918 Gatenby, R. L. Campbell Town.

1908 †*Giblin, Major, L. F., D.S.O., B.A. Government Statistician, Davey Street.

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1920 Gillies, J. H. Macquarie Street.

1918 * Gould, J. W. Tramways Department, Hobart.

1907 Gould, Robert. Longford.

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1921 Hall, E. L. 38 Lyttleton Street, Launceston.

1913 Hardy, G. H. C/o Australian Museum, Sydney.

1918 Harrap, Lt.-Colonel, G. Launceston.

1921 Harris, Miss Ila. Studio, Findlay's Buildings, Launceston.

1921 Harris, Dr. R. E. 73 Cameron Street, Launceston.

1921 L Harvey, David Hastie. "Manresa," Lower Sandy Bay, Hobart.

1902 C Haswell, William, M.A., D.Sc., F.R.S., F.L.S. The University, Sydney, N.S. Wales.

1913 Hawson, Edward. "Remine," 174 Argyle Street, Hobart.

1919 Hay, Rt. Rev. R. S., D.D., Bishop of Tasmania. Bishopscourt, Hobart.

Year of Election.	
1921	Heritage, J. E. 76 Frederick Street, Launceston.
1921	Heyward, F., F.R.V.I.A. 43 Lyttleton Street, Launceston.
1915	Hickman, V. V., B.Sc. "Burnham," Mulgrave Crescent, Launceston.
1919	Higgins, Dr. P. Campbell Town.
1913	Hills, Loftus, M.B.E., M.Sc. Government Geologist of Tasmania, Launceston, Tasmania.
1921	Hill, A. H. 143 Charles Street, Launceston.
1914	Hitchcock, W. E. Moina, Tasmania.
1921	Hogg, W. Public Buildings, Launceston.
1918	Hogg, G. H., M.D., C.M. 37 Brisbane Street, Launceston.
1921	Horne, George, V.D., M.A., M.D., Ch.B. 63 Collins Street, Melbourne, Vic.
1921	Horner, A. G. 16 York Street, Launceston.
1921	Hudspeth, R., Parliament Street, Sandy Bay.
1921	Hughes, J. Public Buildings, Launceston.
1909	*Hutchison, H. R. 1 Barrack Street, Hobart.
1920	Hytten, T. "Eltham," Bathurst Street, Hobart.
1913	Ife, G. W. R., LL.B. Summerhill Road, Hobart.
1918	Irby, L. G. Conservator of Forests, Forestry Department, Hobart.
1898	*Ireland, E. W. J., M.B., C.M. Launceston General Hospital.
1918	Innes, H. S. C/o *Mercury* Office, Launceston.
1919	Jackson, George A. 79 Collins Street, Hobart.
1906	*Johnson, J. A., M.A. Principal of Phillip Smith Training College, Hobart.
1921	Johnson, J. D. 142 St. John Street, Launceston.
1921	Judd, W., M.A. College Street, Launceston.
1921	Keating, Senator J. H. Senate Commonwealth Parliament.
1921	Keid, H. G. W. Geological Survey Office, Launceston.
1911	Keene, E. H. D. Tantallon, Tarleton.
1910	Kermode, R. C. Mona Vale, Ross.
1918	*Kermode, Lewis, B.A. Birkdale, Lancashire, England.
1913	Knight, J. C. E. "Windermere," Claremont.
1918	Knight, C. E. L., B.Sc. Claremont.

Year of Election.		
1919		Knight, H. W. National Mutual Buildings, Macquarie Street, Hobart.
1919		Leahy, F. T. C/o Electrolytic Zinc Company, Risdon.
1887		†Lewis, Sir Neil Elliot, K.C.M.G., M.A., B.C.L., LL.B. "Werndee," Augusta Road, Hobart.
1919		*Lewis, A. N., M.C. "Werndee," Augusta Road.
1912		†Lindon, L. H., M.A. "The Lodge," Park Street, Hobart.
1900		Lines, D. H. E., M.B., Ch.B. Archer Street, New Town.
1921		Listner, J. Parker. Leslie House School, New Town.
1875	C	Liversidge, Professor Archibald, M.A., LL.D., A.R.S.M., F.R.S., F.I.C., F.C.S., F.G.S., F.R.G.S. "Fieldhead," Coombe Warren, Kingston, Surrey, England.
1921		Littler, F. M. 65 High Street, Launceston.
1912		†*Lord, Clive E., Curator and Secretary of the Tasmanian Museum, Hobart. "Cliveden," Sandy Bay.
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1921		Lord, Raymond. "Handroyd," 6 Franklin Street, Hobart.
1921		MacCabe, W. B. Clarence Point, West Tamar.
1919		Mackay, A. D., B.Sc., M.M.E. 4 Fawkner Street, South Yarra, Vic.
1912		McAlister, Miss M. K. Holebrook Flats, Holebrook Place.
1893		*McAulay, Alexander, M.A., Professor Mathematics in the University of Tasmania. The University, Hobart.
1921		McGowan, W. Superintendent of Reserves, Launceston.
1921		McClinton, Dr. R. 70 St. John Street, Launceston.
1921		McInytre, Dr. W. Keverall. 37 Brisbane Street, Launceston.
1902	C	*Maiden, J. H., I.S.O., F.R.S., F.L.S., Director of the Botanic Gardens, Sydney, & Government Botanist of N.S.W. Botanic Gardens, Sydney.
1918		Mansell, A. E. Melton Mowbray.

Year of Election.

1918 Martin, Brig.-General W., V.D. Launceston.

1913 Mather, J. F. 1 Mt. Stuart Road, Hobart.

1921 Masters, A. H. A.M.P. Chambers, Launceston.

1895 *May, W. L. Forest Hill, Sandford.

1921 Meston, A. L., B.A. State High School, Launceston.

1909 Millen, Senator J. D. Roxburgh, Newstead.

1907 Miller, Lindsay S., M.B., Ch.B. 156 Macquarie Street, Hobart.

1921 Miller, W. D. & W. Murray Ltd., Launceston.

1921 Miller, R. M. State High School, Launceston.

1894 L Mitchell, J. G. Parliament Street, Sandy Bay.

1921 Monds, C. F. 4 Adelaide Street, Launceston.

1911 Montgomery, R. B. Davey Street.

1918 Murdoch, Hon. Thomas, M.L.C. 55 Montpelier Road, Hobart.

1921 Murdoch, Ronald. "Marathon," Lower Sandy Bay.

1921 Morris, E. Sydney, M.B., Ch.M., D.P.H., Chief Health Officer, Tasmania. 3 Montague Avenue, New Town.

1921 Muschamp, Rev. E. Holy Trinity Rectory, Launceston.

1882 Nicholas, G. C. "Cawood," Ouse.

1918 Nicholls, Sir Herbert, Kt., Chief Justice of Tasmania. Pillinger Street, Queenborough.

1910 Nicholls, H. Minchin. Government Microbiologist, Dept. of Agriculture, Hobart. Macquarie Street, Hobart.

1919 Nicolson, Norman. "Streanshalh," Campbell Town.

1921 Nye, P. B. Geological Survey Office, Launceston.

1917 Oldham, N., J.P. New Town.

1921 Oldham, W. C. 39 George Street, Launceston.

1919 Oldmeadow, H. E. R. "Lowes Park," Woodbury.

1920 Orr, Dr. Hubert. Campbell Town.

1921 Padman, R. S. 56 St. John Street, Launceston.

1921 Patten, W. H. 59 Cameron Street, Launceston.

1921 Parker, R. L. 81 St. John Street, Launceston.

1908 Parsons, Miss S. R. 190 Davey Street, Hobart.

Year of Election.		
1888	C	Pearson, W. H., M.Sc., A.L.S. 18 Palatine Road, Withington, Manchester, Eng.
1902		†*Piesse, E. L., B.Sc., LL.B. 39 Broadway, Camberwell, Vic.
1910		Pillinger, James, 4 Fitzroy Crescent, Hobart.
1918		Pitt, Frank C. K. "Glen Dhu," The Ouse.
1919		Pitt, C. F. Campbell Town.
1908		Pratt, A. W. Courtney. "Athon," Mt. Stuart Road, Hobart.
1921		Reid, A. McIntosh. Geological Survey Office, Launceston.
1921		Reid, W. D. Public Bulidings, Launceston.
1921		Reynolds, John. Knocklofty Terrace, Hobart.
1919		Riggall, Captain A. Hortin, D.S.O. Tunbridge.
1919		Robinson, J. Moore-. Librarian and Publicity Officer, Chief Secretary's Department, Hobart.
1921		Rolph, W. R. *Examiner* & *Weekly Courier* Office, Launceston.
1919		Rowland, E. O. Secretary Public Service Board, Hobart.
1884		†*Rodway, Leonard, C.M.G., Government Botanist of Tasmania. Macquarie Street, Hobart.
1913		Ross, Hector, Sheriff of Tasmania. Macquarie Street, Hobart.
1921		Savigny, J. 21 York Street, Launceston.
1896		Scott, R. G., M.B., Ch.M. 172 Macquarie Street, Hobart.
1921		Scott, H. H. Curator of the Victoria Museum, Launceston, Tas.
1921		Sharland, M. S. R. C/o *The Mercury* Office, Hobart.
1892	C	*Shirley, John, D.Sc., Principal Teachers' Training College, Queensland. "Cootha," Bowen Hills, Brisbane.
1921		Shields, Hon. Tasman, M.L.C. 13 Patterson Street, Launceston.
1901		Shoobridge, Canon G. W. 3 Molle Street, Hobart.
1921		Shoobridge, Hon. L. M., M.L.C. "Sunnyside," New Town.
1921		Simson, L. 3 St. George's Square, Launceston.
1917		Slaytor, C. H., F.I.C. Misterton, Doncaster, England.

Year of Election.

1901 C Smith, R. Greig, D.Sc. Linnean Hall, Elizabeth Bay, Sydney.

1921 Smithies, F. 34 Patterson Street, Launceston.

1919 Snowden, Colonel R. E. "Minallo," West Hobart.

1896 L *Sprott, Gregory, M.D., C.M. Macquarie Street, Hobart.

1921 Spurling, S., Jnr. Brisbane Street, Launceston.

1919 Stevenson, Miss F. "Leith House," New Town.

1896 L Sticht, Robert, B.Sc., E.M., Mt. Lyell Mining and Railway Co. Ltd. Queen Street, Melbourne.

1921 Strike, R. J. Town Hall, Launceston.

1913 Susman, Maurice. 88 Murray Street, Hobart.

1920 Swindells, A. W. 141 Campbell Street.

1907 Tarleton, J. W. Sandy Bay.

1918 Taylor, Walter E. Elboden Street, Hobart.

1920 Taylour, W. H. Equitable Buildings, Melbourne.

1920 Taylour, Harold. Equitable Building, Melbourne.

1921 Thomas, P. H. "Woolton," Mowbray Heights, Launceston.

1892 C *Thompson, G. M., F.L.S. Dunedin, N.Z.

1921 Thompson, Dr. L. Grey. Patterson Street, Launceston.

1918 †Thorold, C. C., M.A. The Hutchins School, Hobart.

1921 Tymms, Dr. A. O. 18 York Street, Launceston.

1921 Wakefield, F. W. Forestry Dept., Geeveston, Huon.

1918 Walch, Percy. King Street, Sandy Bay.

1901 C Wall, Arnold, M.A. Professor of English Language & Literature in Canterbury College, Christchurch, N.Z.

1913 Wardman, John. Superintendent of the Botanical Gardens, Hobart.

1918 Waterhouse, G. W., B.A., LL.M., Cantab. Messrs. Ritchie & Parker, Alfred Green & Co., Launceston.

1918 Watt, W. The Observatory, Hobart.

1921 Waterworth, A. G. State School, Glen Dhu.

1918 Weber, A. F. Lands Department, Hobart.

Year of Election.	
1921	Webster, Dr. L. Clark. 111 St. John Street, Launceston.
1921	Whitfield, G. Trevallyn, Launceston.
1919	Williams, T. H. Electrolytic Zinc Co., Risdon.
1920	Williams, Hon. W. M., M.L.C., O.B.E. Augusta Road, Hobart.
1901	Wise, H. J. Lambert Avenue, Sandy Bay.
1921	Wright, W. Invermay State School, Launceston.

ANNUAL REPORT

1921.

In accordance with Rule 39, the Council present a Report of the proceedings of the Society for 1921.

The Council and Officers.

The Annual Meeting was held on 14th March, 1921, and the following members were elected as the Council for 1921:—Rt. Rev. Dr. R. S. Hay, Dr. A. H. Clarke, Dr. W. L. Crowther, Major L. F. Giblin, Messrs. W. H. Clemes, W. H. Cummins, J A. Johnson, and L. Rodway.

At a meeting of the Society, held on Monday, 11th April, Mr. J. Moore-Robinson was elected a member of the Council.

During the year Ten Council Meetings were held, the attendance being as follows:—Major Giblin 9, Mr. Johnson 9, Dr. Clarke 8, Mr. Rodway 8, Dr. Crowther 7, Mr. Clemes 7, Mr. Cummins 6, Mr. Moore-Robinson 6, Rt. Rev. Dr. Hay 4.

The Council, at its first meeting, made the following appointments:—

Chairman of Council: Dr. A. H. Clarke.

Standing Committee: Dr. Clarke, Major Giblin, and Mr. Rodway.

Editor of Papers and Proceedings: Mr. Clive Lord.

Hon. Treasurer: Mr. L. Rodway.

Secretary and Librarian: Mr. Clive Lord.

Trustees of the Tasmanian Museum and Botanical Gardens: Dr. Clarke, Dr. Crowther, Messrs. Clemes, Cummins, Johnson, and Rodway.

Farewell to Dr. A. H. Clarke.

Dr. A. H. Clarke, who has been Chairman of the Council of the Society and also Chairman of Trustees of the Tasmanian Museum and Botanical Gardens for many years, retired from these positions at the end of the year, as he is retiring from practice, and proposes to live at St. Helens, on the East Coast. In view of the valuable services rendered by Dr. Clarke, the Council and the Trustees arranged a farewell entertainment, which was held on 12th December, and at which the President of the Society, His Excellency the Governor, presided. Members of the Council were thus able to express their appreciation on behalf of the Society for all that Dr. Clarke had done for it, and also to wish him every success in his new sphere.

Meetings.

During the year one Special and ten ordinary Meetings were held. The details concerning papers read and lectures delivered will be found in the Abstract of Proceedings.

Membership.

Mainly owing to the formation of the Northern Branch of the Society, the membership roll shows a considerable increase. Many of the members did not join until late in the year, and the Society will not reap the full benefit of the increased membership until next year. The roll at the end of the year showed four honorary members, eleven corresponding members, nine life members, and two hundred and seventeen ordinary members.

Obituary.

It is with regret that the Society has to record the death of the following members during the past year:—

T. Bennison, of Hobart (elected 1900).

Hon. C. E. Davies, M.L.C. (elected 1884).

A. J. Taylor, Librarian of the Tasmanian Public Library (elected a member in 1887).

REPORTS OF SECTIONS

Psychology and Education Section.

Six meetings were held during the year, and were well attended.

Officers—L. F. Giblin, Chairman; T. W. Blaikie, Hon. Sec.

A series of papers on "The Examination System" were read and discussed; the subjects and contributors being:—

"To what extent do examinations test the work of Education?" S. R. Dickinson, M.A.

"Inspection v. Examination." T. W. Blaikie.

"Intelligence Tests as a substitute for Examinations." Dr. Morris Miller.

"To what extent can examinations be modified to meet present needs?" L. F. Giblin.

"The Testing of Adult Education." L. Dechaineux and J. A. Johnson, M.A.

Historical and Geographical Section.

The Historical and Geographical Section was first formed in 1899, but has been in recess for many years. During the 1921 Session an effort was made to revive the Section, and a meeting was held on September 2nd, the following members being present:—Dr. W. L. Crowther, Messrs. H. S. Baker, J. W. Beattie, W. F. D. Butler, G. W. R. Ife, Clive Lord, and J. Moore-Robinson.

During the year the following meetings were held:—

September 2nd. Section reconstituted. Officers elected: Chairman, W. F. D. Butler. Secretary, J. Moore-Robinson.

September 15th. Inspection of Mr. J. W. Beattie's Historical Museum.

October 26th. Lecture, "A Voyage from V.D.L. to England in 1839." By Dr. W. L. Crowther.

BRANCH REPORTS

NORTHERN BRANCH.

REPORT, 1921.

A preliminary meeting of those interested in the formation of a Northern Branch of the Royal Society was held in the Mechanics' Institute, Launceston, on the 11th May. At this meeting it was decided to draw up a circular, to be distributed to all who were thought to be interested, with the object of convening a public meeting to see what support the conveners could expect. This meeting was finally held on 10th June, and there was a large attendance, Mr. W. R. Rolph being in the chair. A resolution that a Northern Branch be formed was moved by Mr. Loftus Hills, and seconded by Mr. F. Heyward. The necessary office-bearers

and committee were elected, the following gentlemen consenting to act:—Dr. G. H. Hogg, Rev. J. W. Bethune, Dr. C. W. Atkinson, Messrs. H. H. Scott, Loftus Hills, F. Heyward, G. W. Waterhouse, F. M. Littler, W. D. Reid. Secretary and Treasurer, Mr. J. R. Forward. Mr. G. W. Waterhouse was subsequently elected chairman. This meeting decided to record its appreciation and thanks to Mr. Rolph for his work leading to the formation of a Northern Branch of the Society.

The inaugural meeting was held on 27th June, when the President of the Society, His Excellency the Governor, presided. There was also present a delegation from the Council consisting of Mr. L. Rodway, C.M.G. (Vice-President), Dr. Crowther, Mr. J. Moore-Robinson, and Mr. Clive Lord (Secretary). At this meeting a lecture on "The Application of Science on the Western Front" was given by Mr. Loftus Hills, M.Sc., Government Geologist. The following lectures have been given during the session:—

June 27. "The Application of Science to Warfare on the Western Front." By Loftus Hills, M.B.E., M.Sc.

July 22. "The Application of the Stereoscope to Science." Mr. H. H. Scott.

August 13. "Glimpses of Evolution." Dr. W. K. Gregory.

September 21. "What Astronomy Teaches about the Sun." A. T. Kirkaldy.

October 21. "The Emotions and James' Theory." R. O. M. Miller, B.A.

November 28. "Wonderful Java." H. D. Flanagan.

In addition there were two public meetings held under the auspices of the Branch in the interests of a National Reserve in the Cradle Mountain-Lake St. Clair area.

Mr. G. W. Waterhouse presided at all of these meetings. The Committee have much pleasure in recording a successful session. The membership numbers 63.

ROYAL SOCIETY OF TASMANIA

RECEIPTS AND EXPENDITURE, 1921. GENERAL ACCOUNT

RECEIPTS.				£	s.	d.
Government Grant in Aid of Printing				100	0	0
Special Grant in Aid of Printing A.A.A.S. Papers				100	0	0
Subscriptions—						
Current—169 at	£1	1	0			
Arrears—3 at	1	1	0			
Advance—3 at	1	1	0			
				183	15	0
Payments for use of Society's Room				10	0	0
Sale of Publications				15	18	0
Miscellaneous				15	15	3
				£425	8	3
Dr. Balance, 1921				69	19	4
				£495	7	7

PAYMENTS.				£	s.	d.
Dr. Balance Brought Forward				50	6	6
Salaries				33	10	0
Papers and Proceedings—						
1920 (Part)	£97	13	3			
1921 (Part)	206	15	6			
				304	8	9
Expenses of Meetings				28	9	0
Library and Insurance				18	19	6
Light and Fuel				2	4	2
Lantern and Operator				3	10	0
Postages and Petty Cash				16	17	0
Northern Branch				19	5	0
Miscellaneous				17	2	6
Bank Charges				0	15	2
				£495	7	7

MORTON ALLPORT MEMORIAL FUND ACCOUNT, 1921

RECEIPTS.				£	s.	d.	PAYMENTS.	£	s.	d.
Interest Received from Perpetual Trustee Co.—							Balance Brought Forward	9	14	10
5 Per cent. on £200 War Loan..	£10	0	0				Cr. Balance, 1921	0	0	2
Less Trustee Co. Commission..	0	5	0							
				9	15	0				
				£9	15	0		£9	15	0

£200 was raised by Public Subscription in 1878 to establish a Memorial to the late Morton Allport. The Fund is invested in the name of the Perpetual Trustees, Executors, and Agency Co. of Tasmania Ltd., and the income is used for the purchase of Books for the Library of the Society.

I have compared the Receipt Book, Vouchers, and Bank Book with items particularised in the Cash Book, and found them to be correct.

R. A. BLACK,
Hon. Auditor.

14th January, 1922.

L. RODWAY,
Hon. Treasurer.

CLIVE LORD,
Secretary.

ROYAL SOCIETY OF TASMANIA, NORTHERN BRANCH

STATEMENT OF RECEIPTS AND PAYMENTS, 1921

Receipts	£	s.	d.	Payments	£	s.	d.
To Donation toward Inaugural Meeting	5	5	0	By Expenses of Meetings	5	9	0
„ Pro Rata Refund on Subscriptions Paid ..	14	0	0	„ Lantern Slides	2	0	0
				„ Printing and Stationery	4	13	9
				„ Lanternist	1	10	0
				„ Sundry Accounts	2	8	2
					£16	0	11
				Balance in Savings Bank, 31/12/21	3	4	1
	£19	5	0		£19	5	0

J. R. FORWARD,
Hon. Secretary Northern Branch.

17th January, 1922.

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Titles of Papers, and New Genera and Species in **Heavy Type.**
Synonyms in *Italic.*

ROYAL SOCIETY

OF

TASMANIA

PAPERS & PROCEEDINGS
OF THE
ROYAL SOCIETY
OF TASMANIA
FOR THE YEAR
1922

(With 8 Plates and 10 Text Figures)

ISSUED 26th FEBRUARY, 1923

PUBLISHED BY THE SOCIETY

The Tasmanian Museum, Argyle Street, Hobart
1923

Price: Ten Shillings

The responsibility of the statements and opinions in the following papers and discussions rests with the individual authors and speakers; the Society merely places them on record.

ROYAL SOCIETY OF TASMANIA

The Royal Society of Tasmania was founded on the 14th October, 1843, by His Excellency Sir John Eardley Eardley Wilmot, Lieutenant Governor of Van Diemen's Land, as "The Botanical and Horticultural Society of Van Diemen's Land." The Botanical Gardens in the Queen's Domain, near Hobart, were shortly afterwards placed under its management, and a grant of £400 a year towards their maintenance was made by the Government. In 1844, His Excellency announced to the Society that Her Majesty the Queen had signified her consent to become its patron; and that its designation should thenceforward be "The Royal Society of Van Diemen's Land for Horticulture, Botany, and the Advancement of Science."

In 1848 the Society established the Tasmanian Museum; and in 1849 it commenced the publication of its "Papers and Proceedings."

In 1854 the Legislative Council of Tasmania by "The Royal Society Act" made provision for vesting the property of the Society in trustees, and for other matters connected with the management of its affairs.

In 1855 the name of the Colony was changed to Tasmania, and the Society then became "The Royal Society of Tasmania for Horticulture, Botany, and the Advancement of Science."

In 1860 a piece of ground at the corner of Argyle and Macquarie streets, Hobart, was given by the Crown to the Society as a site for a Museum, and a grant of £3,000 was made for the erection of a building. The Society contributed £1,800 towards the cost, and the new Museum was finished in 1862.

In 1885 the Society gave back to the Crown the Botanical Gardens and the Museum, which, with the collections of the Museum, were vested in a body of trustees, of whom six are chosen from the Society. In consideration of the services it had rendered in the promotion of science, and in the formation and management of the Museum and Gardens, the right was reserved to the Society to have exclusive possession of sufficient and convenient rooms in the Museum, for the safe custody of its Library, and for its meetings, and for all other purposes connected with it.

In 1911 the Parliament of Tasmania, by "The Royal Society Act, 1911," created the Society a body corporate by the name of "The Royal Society of Tasmania," with perpetual succession.

The object of the Society is declared by its Rules to be "the advancement of knowledge."

His Majesty the King is Patron of the Society; and His Excellency the Governor of Tasmania is President.

ROYAL SOCIETY OF TASMANIA

PAPERS AND PROCEEDINGS, 1922

CONTENTS

PAPERS

OF THE

ROYAL SOCIETY OF TASMANIA

1922

NOTES ON CAPTAIN BLIGH'S VISITS TO TASMANIA IN 1788 AND 1792.

By Clive Lord, F.L.S.
(Curator of the Tasmanian Museum.)

(Read 20th March, 1922.)

INTRODUCTION.

Among the annals of Tasmanian discovery the record of William Bligh has scarcely had the attention paid to it which his work merits.

The fact is often lost sight of that the famous *Bounty* anchored for a period in Adventure Bay before proceeding to Tahiti, where the charms of the Eves of the Friendly Islands proved too great a temptation to the crew. The resultant mutiny, and Bligh's famous voyage of 3,600 miles in an open boat to Timor, afford material for those pages of history that are known, in the language of Macaulay, "to every schoolboy."

Bligh's visits to Tasmania are not recorded in the lists of the early navigators given by J. B. Walker (1890 and 1902) or J. Moore Robinson (1921, p. 159), yet Bligh made discoveries and added to the early knowledge of Tasmania, and if it had not been for the rough weather experienced during his second visit, he would almost certainly have forestalled many of the discoveries of D'Entrecasteaux.

Before proceeding to examine in detail the chief events of Bligh's visits to Tasmania in 1788 and 1792, it may be as well to recall the outstanding chapters in his own life's history.

The early portion of this is rather obscure, but 1753 is the usually accepted date of his birth. He joined the Royal Navy at an early age, as he was captain's servant on the *Monmouth* in 1762. He occupied this position for several months, and then, as far as official records go, there is no further trace of his career until July, 1770, when he shipped as A.B. on the *Hunter*. After serving on several ships, he was appointed on 1st of July, 1770, master of the *Resolution*, under Captain Cook, during that navigator's third and last voyage to the South Seas. It was in the *Resolution* that Bligh paid his first visit to Tasmania.

Returning to England, after an absence of four years, he was promoted Lieutenant, and carried out a number of surveys. Such promotion tends to show that he must have shown marked ability early in his career, because not only was he chosen by Captain Cook as sailing master of the *Resolution*, but apparently carried out his work so well that he was immediately raised in rank.

Bligh took part in the battles of the Dogger Bank (1781) and Gibraltar (1782), and shortly after this he was engaged for several years in the merchant service, sailing to many parts of the world.

At this period there was a movement being made to have the bread fruit of the Pacific introduced to the West Indies, where, it was thought, it would feed the natives. Sir Joseph Banks, who did so much to further the exploration of the South Seas, and was a patron of Bligh, secured for him the leadership of an expedition which had for its main object the introduction of bread-fruit trees into the West Indies.

At the end of 1787 Bligh sailed from England in command of the *Bounty*, and, in spite of the mutiny and the enormous difficulties to be overcome, he once more returned to England, on the 14th of March, 1790. He was given a hearty welcome, and promoted Commander, which rank was raised to that of Post Captain during his command of the *Falcon*.

A second expedition was being arranged, and Bligh was again placed in command. His ships, the *Providence* and *Assistant*, left England in 1791, and the task of transplanting the bread-fruit trees to the West Indies was successfully accomplished, and the Captain returned once more to the Motherland in 1793.

He was present at the mutiny at the Nore, and carried out the work entrusted to him by the Admiralty with con-

siderable bravery. He commanded a ship at the battle of Camperdown, and later at the battle of Copenhagen in 1801. In this year he was elected a Fellow of the Royal Society, in recognition of his work as a navigator, and the assistance that his work had been to the cause of science.

In 1805, largely owing to the influence of Sir Joseph Banks, Bligh was appointed Governor-in-Chief of New South Wales, which colony then included the whole of Eastern Australia and Tasmania. He arrived at Port Jackson in August, 1806. His attempts to introduce certain needed, but drastic, reforms met with considerable opposition from a section of the community. This led to an insurrection in January, 1808, when certain military officers placed Bligh under arrest. He was kept in confinement until February, 1809, when he was allowed to embark for England. Bligh was supposed to sail direct, but he called at the Derwent, and was the cause of some concern to Lieutenant-Governor Collins. He returned to New South Wales after the arrival of Governor Macquarie. and finally departed for England in May, 1810.

Bligh eventually returned to England, and the authorities, by their actions, apparently approved, on the whole, of the late Governor's tactics, and gave little encouragement for any military force to depose a Governor in the future. Bligh was appointed a Rear-Admiral of the Blue Squadron in 1811, and a Vice-Admiral in 1814. He died on the 7th of December, 1817.*

The period of Bligh's governorship is not usually referred to in complimentary terms by some authors, but anyone who studies the question cannot but fail to see that such a period was bound to take place at some stage in the colony's history. Bligh was used to the rough life of the high seas. and his manners and methods merely made events to happen with greater rapidity than they otherwise would have done. In fact, the progress of Australia was advanced, as the storm caused by Bligh's arrest led to the Home authorities taking action. As Dr. Watson states, "it forced them to immediate "reforms. It directly caused the recall of the New South "Wales Corps, which, by long residence, had become the most "powerful and perhaps the most evil factor in the community. "It indirectly led to the reform of the law courts, to the

*There are several publications dealing with the life of William Bligh. The best as far as its connection with Australian history is concerned, is that written by Dr. Frederick Watson. (Historical Records of Australia. Series I., Vol. VII., intro.)

"removal of the restrictions on trade and commerce, and to "the general betterment of the conditions of life in the "colony."

Looked at in this light, it will be seen that Bligh's connection with Australian history embraces an era rich in historical events and consequences. In the following pages it is hoped to give some information concerning Bligh's visits as an explorer, to the Southern Isle over which he was later to become Governor-in-Chief.

THE VOYAGE OF THE *BOUNTY*.

The voyage of the *Bounty* is so often referred to that the main outlines may well be recalled before dealing in detail with the events that occurred during her stay in Adventure Bay during August, 1788.

H.M.S. *Bounty* was a vessel of 215 tons. Her extreme deck length being 90ft. 10in., and beam 24ft. 3in. The height in the hold under the main beams at main hatch was 10ft. 3in. In the cockpit were the cabins of the surgeon, gunner, botanist, and clerk, together with steward room and storeroom. Between decks, the great cabin was arranged as a conservatory, and reserved for the plants of the bread-fruit tree. The great cabin extended from the stern to the after hatchway, and had two large skylights and three scuttles for air. A false floor was provided, which was cut full of holes for pots, and the deck, or main floor, was covered with lead, from which pipes led to tubs, in order that the water used for watering the plants could be used on more than one occasion. The master's and captain's cabins were immediately forward of the conservatory. The ship's establishment amounted to forty-four persons, and, in addition, there were two botanists, appointed on the personal recommendation of Sir Joseph Banks, who was taking a keen interest in the natural history of these southern lands. The botanists were David Nelson, who had previously been with Cook, and his assistant, William Brown.

Bligh was appointed to the command on 16th of August, 1787, and immediately began to take an active interest in the fitting out of the vessel. At his instigation the masts were shortened, and less ballast was taken in, nineteen tons being considered sufficient, in place of the customary forty-five tons. On the 9th of October the gunners' stores and guns, four four-pounders and ten swivels, were taken aboard, and the ship was ready for sea. The provisions taken were

sufficient for eighteen months, and, in addition to the usual allowance, there were supplies of "sour krout, portable soup, "essence of malt, dried malt, and a proportion of barley "and wheat, in lieu of oatmeal."

After many delays the ship finally left Spithead on 23rd of December. Supplies were obtained at Teneriffe, which was left on the tenth of January, 1788, and on the twenty third of March the *Bounty* was off the coast of Tierra del Fuego. After fighting against the westerly gales for many days, Bligh was forced to give up the attempt to reach the Pacific by means of the Cape Horn route, and on the twenty-second of April the *Bounty's* bow was turned to the east, and the little ship bore away for the Cape, thence eastward, round New Holland, for the isles of the Pacific.

A month later Table Mountain was sighted, and the ship remained at the Cape until the first of July. On the twenty-eighth the Isle of St. Paul was sighted, and by the middle of August Bligh records that they had much bad weather, with snow and hail on their approach to V.D.L., and that "nothing was seen to indicate the nearness of the coast "except a seal when we were within the distance of 20 "leagues."

On the 19th of August the Mewstone was sighted, but it was not until two days later that the *Bounty* was moored in Adventure Bay, where Bligh remained until the 4th of September.

On the 26th of October Tahiti was reached. Here the *Bounty* remained until the 5th of April, 1789. The bread-fruit trees had been duly secured, but the long stay amidst the Friendly Isles had had a demoralising effect upon certain members of the crew.

On the 28th of April, at daybreak, when the ship was passing south of Tofua, the famous "Mutiny of the Bounty" occurred. Bligh and eighteen others were set adrift in an open cutter.*

Then followed that wonderful feat of seamanship for which Bligh will ever be remembered. Through uncharted seas Bligh navigated his small craft 3,618 miles, and on the 12th of June sighted Timor, Coupang being safely reached on the 14th.

During the stay at Coupang, Nelson, the botanist, died on the 20th of July. Some years later, when the French ex-

*The dimensions of the cutter were (1790, pl. I.):—Length, 23ft. 0in.; Breadth, 6ft. 9in.; Depth, 2ft. 9in.

ploring ships, commanded by Admiral Baudin, were at Coupang, Riédlé, the naturalist of the expedition, died here on the 21st of October, 1801. The French buried him in Nelson's grave, and raised a monument in memory of both naturalists.

Bligh managed to purchase the schooner *Resource*, and reached Batavia on the 1st of October, and, after further trials, eventually returned to England on the 14th of March, 1790. Here he was welcomed as a hero, raised in rank, and given the command of another expedition to the South Seas.

THE *BOUNTY* AT ADVENTURE BAY, 1788.

On the nineteenth of August the Mewstone was sighted, the wind being strong nor'-west. Several fires were noticed inland from South Cape, telling of the presence of natives. The following day was spent in endeavouring to work into Adventure Bay, but variable winds prevented this objective being attained.

At 5 o'clock on the morning of the twenty-first the ship anchored off Adventure Bay. At sunrise the anchor was again weighed, and by noon the ship was worked into the bay and moored. The bearings of the *Bounty's* moorings being: "Penguin Island bearing N. 57deg. ½ E., about two "miles distant; Cape Frederick Henry N. 23deg. E., and the "mouth of the Lagoon S. 16deg. E."

The ship being safely moored, an inspection was made, in order to ascertain the best place to obtain wood and water from. The site selected was at the west end of the beach near where the present jetty stands, as the surf was found to be less at this place than elsewhere. Present-day charts refer to this locality as Quiet Corner, owing to the sheltering effect of the high stone cliff which projects into the bay at this point. The stone forming this headland is remarkably rectangular in certain positions, which accounts for Bligh naming this point "Hewn Stone Head" on his charts of 1792.

The water was obtained from a gully about sixty yards from the beach. Bligh points out that the water was good, but was merely "a collection from the rains, the place is "always dry in the summer months; for we found no water "in it when I was here with Captain Cook in January, 1777." Nevertheless, Bligh saw fit in 1792 to describe the small creek which meanders to the beach at this locality by the name of the "Bounty Rivulet." Resolution River, where Captain Cook

obtained water in 1777, was farther to the north, the larger rivulet at the end of the beach past Hewn Stone Head.

The explorers found no traces of any European vessel having been in the bay since the *Resolution* and *Discovery*. From some of the trunks of the trees which had been cut down during the visit of these vessels in 1777 shoots had grown to a length of twenty-five feet, with a circumference of fourteen inches.

At daylight on the twenty-second a party, under the command of Mr. Christian and the gunner, was sent ashore to commence the wooding and watering operations. There was so much surf on the beach that the wood had to be rafted off in bundles to the boat. During the day the botanists were engaged in examining the surrounding country, and Mr. Nelson is reported as being greatly impressed with the size of the trees.

On the following day, the twenty-third, the surf was greater, and interfered to a considerable extent with the wooding and watering parties. Bligh's narrative states that whilst but poor results were obtained with the seine, many rock cod were caught from the vessel by means of hook and line. Mention is also made of the birds—several eagles, beautiful blue-plumaged herons, a great variety of parrakeets, and a few oyster catchers and gulls. In addition, there were ducks on the lake.

From the twenty-fifth to the twenty-ninth of August the weather was very unsettled, and not much work could be done. A sawpit was dug, and a number of men were employed in, sawing wood into planks. Fish were caught in fairly large numbers, and the seine yielded better results. The anglers were also successful in "the lake."

On the trunk of a dead tree an inscription "A.D. 1773" was noticed. The figures were very distinct, even the slips made by the knife being discernible. This inscription must have been cut by Furneaux's men fifteen years before.

Bligh records that upon Nelson's recommendation he fixed upon the east side of the bay as the most suitable situation in which to plant a number of fruit trees. Apart from the fact that the undergrowth was less in this locality, the soil was also good, but one factor which Bligh was afraid of was the danger of fire, as the natives were in the habit of setting fire to the bush, and in the dry season these fires spread in all directions. However, having chosen the most favourable situation, the following were planted:—Three

young apple trees, nine vines, six plantain trees, a number of orange and lemon seed, cherry stones, plum, peach, and apricot stones, pumpkins, also two sorts of Indian corn, as well as apple and pear kernels. The trees in the vicinity were also marked, and Nelson followed the circuit of the bay, planting in such situations as appeared most suitable.

Unfortunately, the exact positions of the plantations were marked upon Bligh's chart of Adventure Bay which was lost in the mutiny, but from his subsequent chart of 1792, together with the detailed description in the log of the *Providence*, certain of the localities can be fixed. Near the watering place, which was at the head of the cove now known as Quiet Corner, Bligh planted potatoes, onions, and cabbage roots. Certain of the fruit trees were planted near East Cove, for in the log of the *Providence*, under the date of the sixteenth of February, 1792, Bligh records: "It was with "peculiar satisfaction to me to find one of the apple trees I "planted here in 1788—only one remained, and this, although "alive and healthy, had not made a shoot exceeding 12 or 13 "inches."

The foregoing is of interest, for it shows, as far as records go, that the first apple trees and potatoes were planted in Tasmania in August, 1788, by the botanists—David Nelson and William Brown—of Bligh's expedition.

On the first of September some natives were seen in the distance, and hopes were entertained that they would come towards the ship. Fires were seen on the low land to the north-west. As the natives did not appear, on the following day Bligh set out in a boat, but was unable to land in the vicinity where the natives had been seen. After waiting for some time, Bligh records: "We heard their voices like the "cackling of geese, and twenty persons came out of the "wood, twelve of whom went round to some rocks where the "boat could get nearer to the shore than we then were. "Those who remained behind were women.

"We approached within twenty yards of them, but there "was no possibility of landing, and I could only throw to the "shore, tied up in paper, the presents which I intended for "them. I showed the different articles as I tied them up, "but they would not untie the paper until I made an appear- "ance of leaving them. They then opened the parcels, and, "as they took them out, placed them on their heads. On see- "ing this, I returned towards them, when they instantly put "everything out of their hands and would not appear to take "notice of anything that we had given them. . . . . .

"When they first came in sight, they made a prodigious "clattering in their speech, and held their arms over their "heads. They spoke so quick that I could not catch one "single word they uttered. We recollected one man, whom "we had formerly seen among the party of the natives that "came to us in 1777 . . . . . Some of them had a small stick, "two or three feet long, in their hands, but no other weapon.

"Their colour, as Captain Cook remarks, is a dull black; "their skin is scarified about their shoulders and breast. They "are of middle stature, or rather below it. One of them was "distinguished by his body being coloured with red oker, but "all the others were painted black, with a kind of soot, "which was laid on so thick over their faces and shoulders "that it is difficult to say what they were like.

"They ran very nimbly over the rocks, had a very quick "sight, and caught the small beads and nails which I threw "to them with great dexterity. They talked to us sitting on "their heels, with their knees close into their armpits, and "were perfectly naked."

The foregoing reference to the Tasmanian aborigines is given almost in full, because of its interest as a first-hand observation of these natives in their primitive state. So many of the records relating to the former inhabitants of our Island State are based on observations made after the settlement, that it behoves all who take an interest in the characteristics of the departed race to take every opportunity of referring to those records, alas! so few in number, which were made by the early explorers in the era preceding the settlement.

Apart from Bligh's personal observations with regard to the dusky inhabitants of Adventure Bay, we have the testimony of Brown, the botanist, who met several during the course of his excursions in the bush. Brown also reported that he "saw some miserable wigwams, in which were "nothing but a few kangaroo skins spread on the ground, and "a basket made of rushes."

On the same day as he had the interview with the natives Bligh landed on the point near Penguin Island, and from the high land in the vicinity secured an extensive view of what he took to be Frederick Henry Bay, but which was in reality the channel which now bears the name of D'Entrecasteaux, after its French discoverer. Bligh also refers to the island "in or near the middle of the bay." The island referred to being now known—in company with many others around the shores of Tasmania—as Green Island.

A calm on the third of September prevented the *Bounty* sailing, but on the following day, with the aid of a fresh nor'-westerly breeze, the anchor was weighed, and the ship entered upon the last stage of her voyage to Tahiti, which was reached on the twenty-sixth of October, 1788.

THE VOYAGE OF THE *PROVIDENCE* AND THE *ASSISTANT*, 1791-1793.

Upon Bligh's return to England after the sensational mutiny of the *Bounty*, he was proclaimed a hero, and was soon given command of a second expedition, in order to transplant the bread fruit to the West Indies. Two vessels were this time placed at his disposal. The first was the *Providence*, a three-deck ship of 420 tons, and having a keel length of 98 feet, which had only been launched at Blackwall on the 23rd of April, 1791. Her complement was 134 men, and armament twelve guns and fourteen swivels.

The *Assistant* was a brig of 110 tons, and a keel length of 51 feet. Her complement was 27 men, and armament four four-pounders and eight swivels.

It is of interest to note that Matthew Flinders, who later was to play such a prominent part in Australian exploration, was a midshipman on the *Providence*. The two botanists selected for the expedition were James Wiles and Christopher Smith.

The *Providence* and *Assistant* left England on the third of August, 1791, and reached Teneriffe a fortnight later, where they stayed until the sixth of September. On the third of October the Equator was crossed, and Table Bay entered on the sixth of November. Sailing from the Cape on the twenty-third of December, the ships passed the Isle of St. Paul on the eighteenth of the following month, and on the eighth of February, 1792, sighted Tasmania. Leaving here on the twenty-fourth of February, Tahiti was reached on the ninth of April. Here they stayed until the twentieth of July, on which date the return voyage was commenced. After touching at Fiji, making his way by skilful navigation through Torres Straits, Bligh once more reached Coupang (Timor), on the second of October.

The Cape was rounded in November, and Christmas was spent at St. Helena. On the twenty-third of January, 1793, the ships arrived at Jamaica, and Bligh's task of transporting the bread fruit from the South Seas to the West Indies had been successfully accomplished.

The ships finally reached the end of their long voyage on the seventh of August, when they anchored at Deptford.

THE *PROVIDENCE* AND *ASSISTANT* AT ADVENTURE BAY, 1792.

At a quarter to six on the morning of the eighth of February, the southern coast of Tasmania—or, as it was then called, Van Diemen's Land—was sighted. The morning was hazy, and there were a few "porpoises," shags, gannets, and Cape hens noted in the vicinity of the ship.

At midday the soundings gave seventy-two fathoms, there being light airs and fine winds, which did not tend to rapid progress, and it was midnight before the rocky cliffs of Cape Frederick Henry were discerned to the N.N.W. At daylight on the following morning the boats were sent ahead to tow, and by half-past seven the *Providence* and *Assistant* were anchored in Adventure Bay, the bearings of the *Providence's* moorings being as follows:—Penguin Island N. 64 deg. E. Cape Frederick Henry N. 25deg. E. West end of beach, West ¾ mile. The depth being ten fathoms.

As soon as the ships were moored, Bligh went ashore to select the best places from which to secure his supplies of wood and water. He decided to obtain the wood from the same place as he had done in 1788, namely, the site near the west end of the beach, near the present jetty in Quiet Corner. The best water he found at the watering place of the *Resolution*—"about a half-mile without the west end of the beach." Bligh records that the water from this stream, which he charts as Resolution River, is the best water in this place if not as good as any whatever. (See Text fig. I.)

Near Resolution River a "wigwam"—one of the rough shelters made by the aborigines—was discovered, and traces were observed of the natives having recently been in the vicinity. Many mussel shells and crayfish remains were heaped up, as though they had fed there for a considerable time. Bligh also states: "We picked up some handfuls of "fine shavings of wood, which I believe they prepare to light "their fires with, and a bundle of dried inside bark tied up, "two foot long, intended for a flambeau. The wigwam would "cover about six people—its form is a perfect section of a "beehive, the open part being to the N.E. The covering was "large pieces of bark, but was neither wind nor water tight."

A sawpit which had been constructed in 1788 was partly filled up, but the cross logs remained in position, and also

one of the large posts. The seine was tried on the beach, but without great success, better results being obtained by fishing with hook and line from the ship, as by the latter method considerable quantities of large red rock cod were caught. The afternoon of the day of their arrival was "given "to the people to take their rest in," the stations being fixed for the following day, and everyone ordered to breakfast at 7 a.m.

In spite of the preparations made for an early start on the morrow, Bligh was to suffer a disappointment, as the weather was so squally and rainy that work could not be commenced until late in the morning, and in the afternoon the first launch load of wood was received on board. Bligh records that "Mr. Wiles and Mr. Smith, the botanists, were "employed about the hills, and I planted in the fresh water at "the east end of the beach a pot of watercress—on a tree a "few yards from it, I had cut a memorandum."

On the following day, Saturday, the eleventh, the weather improved, and at 7 o'clock the wooding and watering parties were sent ashore, as well as the pinnace being sent to Penguin Island to secure grass. It had, however, blown strongly from the south-west during the night, and there was a considerable surf on the beach, which made the work of the various parties rather difficult.

Bligh had a small boat belonging to the *Assistant* carried into "the lake," for the purpose of examining it. He found that the principal arm was about twenty yards wide, and in different parts had 3, 4, 8, 6, and 13 feet of water. From the main arm there were several smaller branches, in which there was 2, 4, and 6 feet of water in various parts. Bligh describes "the lake" as winding through a flat circumscribed by hills, the water being brackish in all parts. The flat itself was swampy, and the vegetation mostly wire grass and a few scrubs. The "lake" abounded with bream, and numbers of wild ducks were seen.

The same day that Bligh carried out his exploration of "the lake" he sent the botanists to plant certain trees upon the rising grounds near the east end of the beach, and the following is a list of the items planted:—Three fig trees, nine oaks, three quinces, three pomegranates, one rosemary, and twenty strawberry plants.

On the twelfth there was a moderate southerly breeze and a sharp air, the "wooders, waterers, grass cutters, and "broomers employed, and at leisure moments hauling the

"seine and catching fish with hook and line." As a result of their exertions, four cutter loads of wood and three launch loads of water were received on board the *Providence.*

In the calm of the Sunday evening Bligh took his rod and line to "the lake," and in an hour landed twenty-one bream, varying from half to one pound in weight. The seamen also secured a few oysters when hauling the seine, which circumstance caused Bligh to have a dredge made, with the object of securing a larger haul of these shellfish, but success did not reward the efforts of the dredgers.

On Monday, owing to northerly winds, some difficulty was experienced in getting the wood and water off to the ships. The seamen continued to catch large numbers of rock cod, and the anglers in "the lake" had good sport, securing large hauls of bream up to two pounds in weight. Bligh himself paid a visit to Penguin Island, and inspected the ships' goats, which had been landed, soon after arrival, on the island, in order to graze on the long wire grass, which the sheep and goats appeared to appreciate after their long journey on the ships. Bligh gives the bearing of "an island "in Frederick Henry Bay," which would be the present Green Island in D'Entrecasteaux Channel. The point of land near Penguin Island is referred to as Grass Point.

At daylight on Tuesday, the fourteenth, it was found that there was too much surf at Resolution River to continue getting water from that place. The wind was now from the west to south-west, and was bringing showers of rain. The wood cutters were able to continue their work at the original site, but experienced difficulties in getting the cargoes to the ships. Lieut. Portlock was accordingly sent to examine East Cove (the bay which is now generally spoken of locally as Dorloff's Beach). The water was found not so good as that at Resolution River, but the surf was considerably less in this locality.

Bligh refers to the lizards, etc., that were seen, and also gives a description of a black cockatoo which was shot.

On the following day (Wednesday) the weather was again squally, and both the wooding and watering parties were sent to East Cove, but in this locality the water casks had to be rolled for a distance of one hundred and fifty yards.

Next day the working parties were again sent to this locality, the country at the back of which is described as

being a fine valley, and the trees exceptionally large. Kangaroos were seen here, and it was with pleasure that Bligh noticed one of the apple trees which had been planted during his previous voyage in 1788.

On Friday, the seventeenth, no water could be taken off, owing to the fact that the strong winds had caused the salt water to bank back up the creeks, and render the water brackish for a considerable distance up stream. The botanists had been busily engaged in collecting specimens, and had travelled back as far as Nelson's Hill. This hill was named after Nelson, the botanist of the *Bounty*, who survived the perils of the boat voyage, but died at Timor. The description of Nelson's Hill as it occurs in the log is as follows:—

"This hill lies S. 10deg. E., three miles distant as a bird "flies, from the west end of the beach. The top is covered "with smaller trees than the parts below, but none of the "forest kind; so that the summit of it appears to be bare. "On the top of the hill is a large oblong rock of granite, on "which a dozen men may stand with ease. It is nine feet high "on one side, and seven on the other. . . . . On Nelson Hill "they found no mark of fire, so that we may readily suppose "the natives do not take the trouble to go near it."

On the Saturday the weather became worse, and reference is made to the fact that "some snow lay on the Table "land during the whole day—so unfavourable is the season." The "Table land" referred to is Mount Wellington. It is of interest to note this reference, as Bligh on his chart of the southern portion of Van Diemen's Land marks "Table Hill" for the high mountain which is designated Mount Wellington at the present day. Doubtless, coming direct from the Cape, its configuration, under certain conditions, would tend to remind the voyagers of Table Mountain at the Cape. In dealing with this question, it should be noted that Ida Lee (1920, p. 29) makes the statement that "Bligh's charts are the first "to show Table Mountain (Mount Wellington) or any part of "the strait, the outlet and entrance of which were afterwards "found by D'Entrecasteaux." As far as its official designation of Table Mountain goes, however (for it was called such in the early days of the colony), the name would appear to have been given at a later date, for we read in a despatch from Lieut.-Governor Collins to Governor King (Historical Records of Australia, Ser. III., Vol. I., p. 292), under the date 8th December, 1804, the following passage:—"The mountain "in my vicinity (which in the French chart is named Le

"Plateau), from some similarity in its appearance to that at "the Cape of Good Hope, I have denominated the *Table* "*Mountain*, but I have not altered any English name wherever "I have found one given."

There is no reason to think for a moment that Collins knew of Bligh's previous designation, or even knew that Hayes in 1793 had named the same mountain "Skiddaw." Nevertheless, the honours, as far as priority go, remain with Bligh.

To return, however, to the doings of the *Providence* and *Assistant* in Adventure Bay, on that unseasonable February day of 1792, we find that, in spite of the weather, the work of securing supplies was being pushed on with, but that it was necessary to go three hundred yards farther up the creek in East Cove—which Bligh charts as Providence Rivulet—in order to avoid the brackish water. Among other observations occurring in the narrative of the events of the day it is noted that fires caused by the natives were seen in the distance, and that "our carpenter knocked down an animal to-"day called, by the seamen, a galley wasp." From the detailed description which follows, there can be no doubt that this was one of the Blue-tongued Lizards (*Tiliqua*). There is also an interesting note concerning a Porcupine Anteater (*Tachyglossus aculeata* var. *setosa*) which was killed, but, as I have previously (1920, p. 120) dealt in detail with this description, there is no need for further mention here.

The bad weather meant more to Bligh than he realised at the time, for had he had fair weather during his stay, he would in every probability have forestalled the discoveries of D'Entrecasteaux. The proof of this is forthcoming by reference to the following note:—"I have every day intended to "go round into the Bay of Frederick Henry in the *Assistant*, "but the weather is so bad that I cannot do it with propriety, "and my time now makes it doubtful if I can accomplish "it."

On Sunday, the nineteenth, the gale continued from the south-west, with hail and rain, but every endeavour was made to complete the supplies of wood and water, and to get the ships ready for sea. As no signs had been seen of the natives, Bligh allowed two or three men to go on shore on leave each day, and on the Sunday afternoon one of these parties fell in with twenty-two natives at Gully Head.

Upon the return of this party to the ship the meeting was reported to Bligh, but to judge from his remarks, as

written in the log, he does not place much reliance upon the detailed observations made on this occasion by the members of his crew.

The following morning preparations were made to depart from Adventure Bay. In the morning Bligh made an excursion in search of the natives, but found that they had left the locality. Upon his return to the ships he was ready to sail, but found that one of the crew of the *Assistant* was missing, and a search was therefore commenced. Success did not reward the efforts of the search parties until the following day, and so it was not until Tuesday, the twenty-first, that the ships sailed. Owing to calms they were unable to proceed far, and again anchored, the bearings being Cape Frederick Henry N. 24deg. E., Penguin Island E. one mile, and Nelson Hill S.E. Depth fifteen fathoms.

Bligh's log records that "As a last service I could offer "to this country, I sent on shore by Lieut. Bond a cock and "two hens, to be let loose on the high grounds within Penguin "Island. Two goats that were sent on the island to graze "could not be found, and were left behind, but, unfortunately, "neither of them was a male, nor have we one on either of the "ships, so no benefit can be derived from these animals."

On Wednesday the ships sailed towards the north, as Bligh was anxious to examine the coast, but, owing to the wind freshening from the south, he did not proceed more than about five miles above Cape Frederick Henry. Apparently it was with regret that the proposed exploration had to be abandoned, for Bligh states that "I did not feel myself "justified to examine this place, from my being so late in "the season for Otaheite. I therefore reluctantly gave it "up."

By noon the wind had increased considerably, and the ships had some difficulty in working out of Storm Bay. The *Assistant* met with a slight mishap, and the ships put back to Adventure Bay, in order to repair the damage. This work took some time, and it was the twenty-fourth of February before the ships finally departed from Tasmania—or, as it was then known, Van Diemen's Land.

In his remarks concerning his stay at Adventure Bay, Bligh states that this, "my third visit to this country, has "been attended with scarcely any new occurrence. I had "hopes my endeavours to serve it in my last voyage might "have been productive of some good, but of all the articles I

"planted, only one apple tree remains alive and in a healthy "state, and perhaps being now habituated to the soil, may, if "it escapes the accidents that are incidentally more than wind "and weather, provide fruit. . . . . . I have never seen "any reason to hope that the hogs left by Captain Cook, or "any breed of them, were alive. I am, however, sanguine in "my expectations that the cock and two hens I have now left "will breed and become wild. Perhaps the most valuable "of the articles I have this time planted are nine fine young "oak plants, about 8 inches high. They were planted in East "Cove, on the slope of the hill on the left-hand side of the "flat as you land, about 200 or 300 yards from the water "side. A little below the oaks are planted five fig trees, "three pomegranates, three quinces, and twenty strawberry. "On Penguin Island and Grass Point we sowed fir seed, apri- "cot and peach stones."

The above extract does not quite agree with a previous entry in the log, as in the first instance the number of fig trees planted is given as three, which was apparently the correct number, for Labillardiere, in describing D'Entre-casteaux's visit to Adventure Bay in February, 1793, just a year after Bligh had left, states (1800, p. 324):—"We saw "three young fig trees, two pomegranate trees, and a quince "tree they had planted, which had thriven very well, but it "appeared to us that one of the trees they had planted in "this country had already perished, for the following in- "scription, which we found on the trunk of a large tree near, "mentions seven:—*Near this tree Captain William Bligh "planted seven Fruit Trees,* 1792. *Messrs. S. and W. Botan- "ists.* The other inscriptions were couched in similar terms."

Bligh refers to the fact that the "wigwams," as he terms the rough shelters of the natives, had large heaps of "muscle shells and some oysters and crawfish in them." Comment is also made on the fact that no fish bones were seen near the natives' feeding places, but Bligh was not aware that the Tasmanian aborigines did not eat scale fish. Reference is also made to the observation that the natives appeared to avoid the sea waves as much as possible, and when gathering shellfish along the shore they would quickly retire before an advancing wave. Bligh considered that the natives retired during the boisterous season of the year to places not exposed to the sea winds, and from the number of fires seen inland, Bligh came to the conclusion that the native population was larger than had been previously sup-

posed. Certain other remarks concerning the aborigines are worth repeating:—

"It has been supposed from small baskets being found "containing flints, that they get fire by collision, but I have "not heard of any fungus discovered or any substitute for it "that will contain sparks made by collision. I have found "rolls of peculiar bark which is taken from the trees of the "smallest species of the Metrocedera that I conceived "would have effected this purpose, but with the fairest trials "I could not accomplish it, although a small particle of col-"lected fire put among it will soon generate such a body as "to secure the part ignited from being extinguished in the "wettest weather. It appears that they have some trouble "in making fire, for, besides this dry bark, there are shav-"ings of some light wood which has the appearance of being "taken off by a plane iron of one-eighth of an inch wide. "Several handfuls of these shavings lay about most of the "wigwams that I saw. I apprehend they are formed by the "sharp end of a muscle shell."

The foregoing passages throw some light upon the customs of the aborigines, but Bligh evidently mistook the chipped stone "scrapers" and other such palæolithic weapons of this primitive race for flints. As a matter of fact, there is no true flint to be found in Tasmania, but many of the stones from which the aborigines made their stone implements, with which they made their spears—and hence the "handfuls of shavings"—were very like flint in appearance. The idea that the natives ever obtained fire by means of flint and tinder can. be dismissed. The larger question as to whether they were able to obtain fire by means of the stick and groove is also open to doubt for several reasons. The one fact we can be sure of is that fire was difficult to obtain, and the aborigines, before the advent of the white settlers, usually carried torches of bark with them, and set numerous fires going along the course of their travels. In this manner they not only cleared the country, but usually had some trace of fire within a reasonable distance.

PREVIOUS VISITORS TO TASMANIA AND OBSERVATIONS REGARDING ANCHORAGES IN ADVENTURE BAY.

In order to place Bligh's visits in correct chronological sequence, it is well to recall the previous explorers, as well as those who followed soon after. The first, of course, was

Tasman, who in 1642 attempted to anchor in Adventure Bay, but was driven to sea by a nor'-west gale, and finally anchored on the East Coast. He named the bay a little to the north of his anchorage Frederick Henry Bay, but, owing to subsequent errors, the name is now bestowed upon a bay which Tasman did not see, whilst the true Frederick Henry Bay of Tasman is known as Blackman's Bay. In 1772 Marion du Fresne anchored in Marion Bay, his visit being noted chiefly for an unfortunate encounter with the aborigines. In March, 1773, Captain Furneaux anchored the *Adventure* in the bay which he named after his ship. He considered the Frederick Henry Bay of Tasman to be a few miles to the north of his anchorage, and called the north point of the bay Cape Frederick Henry. His error was not observed by Captain Cook, who anchored in Adventure Bay in January, 1777.

During January, 1788, the First Fleet passed along the south coast of V.D.L., on their mission to form the first settlement in N.S.W., and in August of the same year the *Bounty* anchored in Adventure Bay. Captain Henry Cox, in the *Mercury*, visited the southern and eastern coasts in July, 1789.

The *Providence* and *Assistant* anchored in Adventure Bay in February, 1792, and in April and May of the same year D'Entrecasteaux explored the Channel, which bears his name. The following year the French Admiral returned to Tasmania, and in February anchored in Adventure Bay.

In April of the same year (1793) Sir John Hayes carried out his surveys, and the only other explorers before the settlement of whom we have record are Flinders and Bass (1798-99) and Baudin (1802).

Some authorities include La Perouse among the early explorers of our island State, but for reasons given in a previous paper (1920, p. 124) I see no reason for such action.

As regards the details of each visit, there are many points of interest. Amongst others, the localities of the various anchorages can be plotted, as the bearings are given in the different accounts, the anchorages being as follows:—

Furneaux, 1773—
(*Adventure*)

Seven fathoms.
Cape Frederick Henry NNE ½ E.
Penguin Island N.E. by E. ¾ E.
Watering Place W ½ N.

Cook, 1777—
(*Resolution* and *Discovery*)
12 fathoms.
Cape Frederick Henry N. 33deg. E.
Penguin Island N. 84deg. E.

Bligh, 1788—
(*Bounty*)
Cape Frederick Henry N. 23deg. E.
Penguin Island N. 57deg. ½ E.
Mouth of lagoon S. 16deg. E.

Bligh, 1792—
(*Providence* and *Assistant*)
10 fathoms.
Cape Frederick Henry N. 25deg. E.
Penguin Island N. 64deg. E.
West end of beach West ¾ mile.

D'Entrecasteaux, 1793—
(*Recherche and Esperance*)
11 fathoms.
Nearest shore S.E. distant 5 furlongs.
Penguin Island N. 51deg. East.

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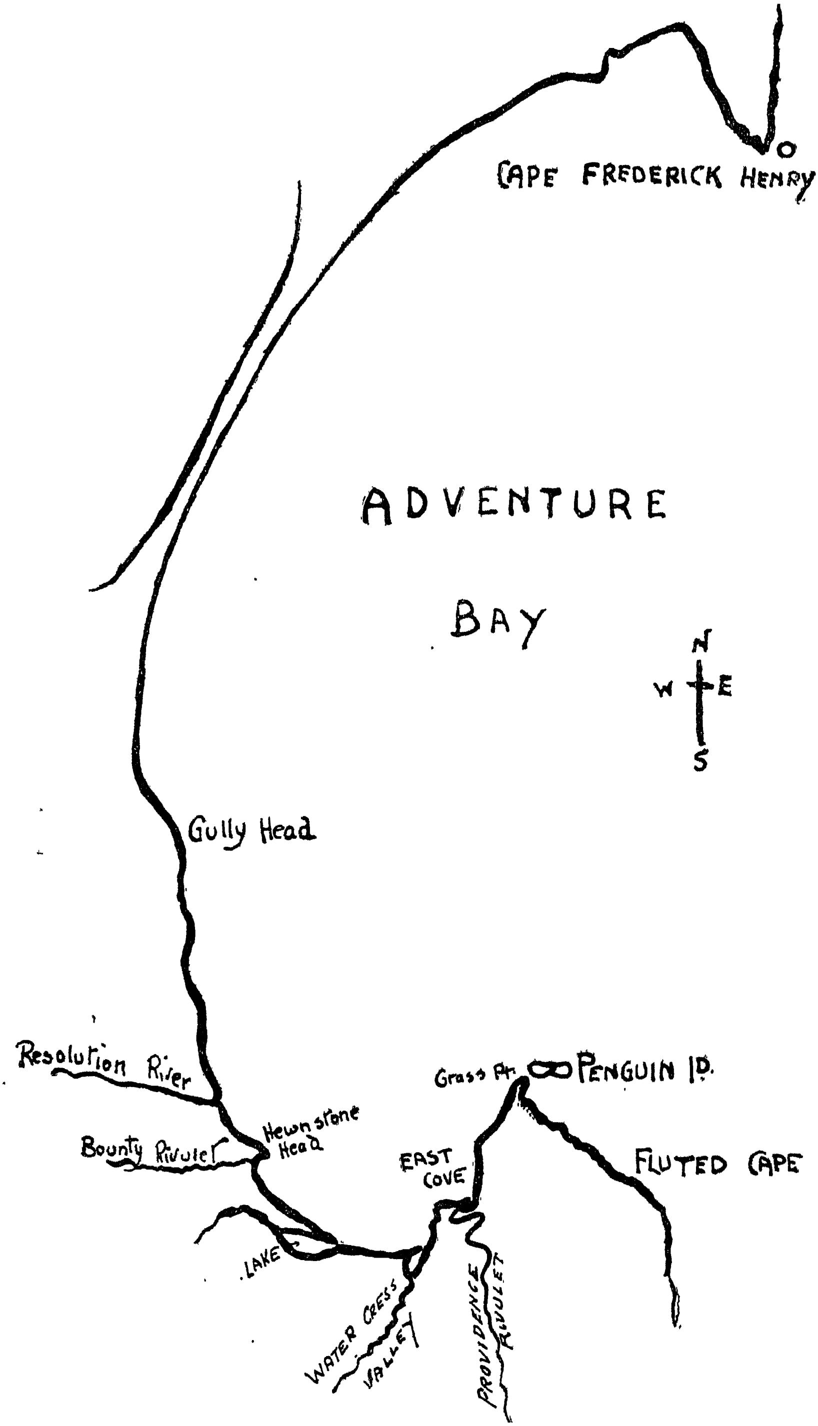


SKETCH OF ADVENTURE BAY,
Based on Bligh's Chart of 1792.

STUDIES IN TASMANIAN MAMMALS, LIVING AND EXTINCT.

Number VII.

By

H. H. Scott, Curator of Victoria Museum, Launceston,

and

Clive Lord, F.L.S., Curator of Tasmanian Museum, Hobart.

(Read 20th March, 1922.)

A NOTE ON THE TURBINOID CELLS AND ALLIED DATA OF *NOTOTHERIUM MITCHELLI.*

When treating the skull of *Nototherium mitchelli* to extract the iron, and so render it fit for future preservation, we carefully set aside the whole of the mud that came from the nasal cavity, intending later on to search for fragments of the turbincid bones. After considerable expenditure of time upon the unpromising mass, we are now able to report the recovery of about one half of one of the maxillo turbinals, and herewith record the following facts. In structure the texture is about twice the degree of coarseness that obtains in the living Kangaroos, but its general structure is akin to the turbinal of a Wombat, and departs considerably in outline from both that of the Kangaroo and the Native Bear. The central laminæ of these Nototherian bones were very extensive, and reached the vomer and palate by two vertical plates, that pressed against the premaxillaries outwardly, and the nasal septum mesiad. The edges of the premaxillaries, in these skulls, curve into the nasal cavity in two loop-like folds, quite unlike anything found in the skulls of allied Marsupials; and the walls of the nasal cavity are not bulged outwards, at the roots of the zygomatic arches, as we find in the skulls of Wombats, but slope straight backwards, all of which means a relatively narrower turbinoid surface, but a vertically deeper one.

The region which, in the Kangaroos, gives rise to a nasal spine (elaborated out of the premaxillary)—that reaches a maximum development in the extinct giant *Palor-*

chestes—is an open channel in the Wombat, and a solid platform in the *Nototheria*, which pushed the turbinals relatively farther back, the total result being as follows:—

1. In being straighter, and more cuneiform in shape, the maxillo turbinals of the *Nototheria* approach those of the Kangaroos, and depart from those of the Wombats.

2. By reason of their more extensive vertical plates, they approach the Wombats, and depart from those of the Kangaroos.

3. By being preceded by a bony platform, the Nototherian turbinals manifest characters of their own, although such states are dimly suggested in the skulls of Native Bears.

A suggestion thrown out in the Monograph upon *Nototherium tasmanicum* (p. 46) as to the existence of nasal diverticula in the *Nototheria*, has been recalled by Doctor William K. Gregory's studies upon the American *Titanotheres*, and his recent examination of their Australian marsupial analogues, the *Nototheria*. Doctor Gregory concludes that nasal diverticula did exist in both groups of animals. Again, the very perfect skull of *Nototherium mitchelli*, now available to students of palæontology, makes it possible to see how the hinged nasal cartilage and enormous zygomaticus muscles (that strained up the angles of the lips with inordinate power) rendered a relatively small effort upon the part of the levator labii superioris muscles effective in pulling up the heavy trunk-like lip.

The attachment and action of the muscles just named were clearly demonstrated in the Indian Rhinoceros as early as the year 1851 by Sir Richard Owen, and there can be no doubt that he carried this idea in the foreground of his mental vision when he came to study the *Nototheria*, but being diverted from his first thought by a too close association of the teeth of Diprotodons with those of *Dinotherium*, he dispatched the Rhinoceros aspect of the *Nototheria*, and their allies, with a minor reference.

Owen's actual sketch of the myology of the Rhinoceros is before us, and the more we study his work upon the Rhinoceros, and the *Nototheria*, the more we are convinced he strongly leaned to a belief respecting the Rhinoceros-like habits of *Nototherium mitchelli*—but awaited in vain the coming of a perfect skull to prove his case.

ON *PHASCUM TASMANICUM.*

BY H. N. DIXON AND L. RODWAY, C.M.G.

(With 1 Text Figure.)

(Read 10th April, 1922.)

Phascum tasmanicum, sp. nov. Gemmiform, 1-2 mm. high. Leaves numerous, broadly ovate-lanceolate, acuminate; upper margin closely revolute; midrib yellow, strong long-excurrent in a squarrose recurved point; upper cells quadrate, each bearing two or three bold papillæ, lower ones rather longer, smooth, colourless. Capsule on a very short seta, nearly globose, minutely apiculate.

Mr. H. N. Dixon writes:—

" It is quite different from any described species; and I " suggest the name *Phascum tasmanicum,* Rodway and " Dixon. It is nearest, perhaps, to *P. floerkeanum,* W. et M., " but the longly excurrent, squarrose-recurved nerve, strongly " recurved margin, and highly papillose cells, distinguish it " clearly."

EXPLANATION OF FIGURE.

Phascum tasmanicum, sp. nov.

Fig. 1. Three times natural size.

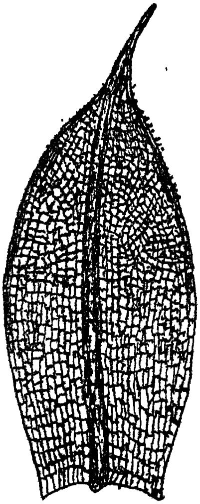
Fig. 2. Plant.

Fig. 3. Leaf.

Fig. 4. Section of leaf.

Fig. 5. Surface papillæ.

Fig. 6. Sporogonium and calyptra.



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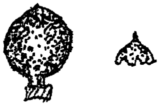

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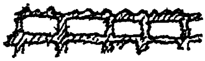

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A BIOMETRIC STUDY OF THE CONIDIA OF *MACROSPORIUM* AND *ALTERNARIA*.

By F. W. Wakefield,

District Forester, Southern Tasmania.

(With 1 Text Figure.)

(Read 10th April, 1922.)

Alternaria and *Macrosporium* are closely allied genera of the *Hyphomyctaceæ*, both being included in the section *Dictyosporæ* of the *Dematicæ*. They are differentiated by their methods of conidia-formation. In *Macrosporium* a conidiophore bears at its apex a single conidium, which attains its full size, matures, and finally becomes detached. In the case of *Alternaria*, the conidiophore produces at its apex a chain of conidia, each of which is morphologically identical with the single conidium of *Macrosporium*. This chain of conidia produced by *Alternaria* eventually becomes broken up into individuals which cannot be distinguished from a detached conidium of *Macrosporium*. It is, therefore, only possible to refer a particular species to one or other of these two genera when the manner in which the conidia are produced has been determined. Consequently, many species have been incorrectly placed, owing to inaccurate observations on the conidia and method of conidia-formation.

The abundance of species apparently placed indiscriminately in either genus and having synonyms in the complementary genus is evidence of the fact that these two genera are much confused. Thus *Alternaria solani*, Sorauer=*Macrosporium solani*, E. & M.

The ease with which the concatenate conidia of *Alternaria* become fragmented into free individuals when mounted in water for miscroscopical examination explains the frequency of inaccuracies in classification. It will be seen that when a species of either genus is mounted in water the resulting "object" is the same, *i.e.*, there will be similar conidiophores and morphologically identical conidia. It will be shown later, however, that these latter may be

differentiated by a simple Biometric method. It has been found possible to determine the mode of origin of such a mass of free conidia from their co-efficient of variability.

VARIATION IN SPORE MEASUREMENTS.

It is usual to include in the diagnoses of fungi measurements of their mature spores, and it is not uncommon to find different authorities quoting different figures as diagnostic characters of one and the same species.

The following measurements for the length of the spores of *Coprinus comatus*, Fries, are taken from publications by the eminent authorities given below:—

COPRINUS COMATUS, Fries.

W. G. Smith	18μ.
G. Massee	15μ.
M. C. Cooke	14μ.
R. Buller	12.6μ.
Britzelmayer	12μ-14 μ.
Karsten	11μ-13 μ.

This lack of uniformity in the published measurements led Massee (1) to re-examine many of the types preserved at Kew. Although a useful character for the differentiation of various species, the size of fungus spores is subject to considerable variation. Buller (2) gives an interesting account of differences in form and size of the spores of *Amanatopsis vaginatus*, Bull.

Some time ago, when measuring the dimensions of conidia produced by a *Cladosporium* (3) occurring on wheat, a considerable range of variation was noted. A considerable number were measured very carefully, with the object of determining the limits of size, in order to prepare an accurate diagnosis of the species. Records of several other species were subsequently made. (4) From a casual study of these records it became apparent that in certain species wide variations may occur, whilst in others the range of variation determined was within narrow limits. This ultimately led the writer to make a really critical examination of two common species, with interesting and unexpected results, which are here presented.

(1) Massee, G. "Grevillea," Vol. 21, p. 77.
(2) Buller, R. "Researches on Fungi."
(3) *Cladosporium graminum*, Corda=*Scolecotrichum graminum*, Fuchel.
(4) *Volvaria speciosa, Peziza vesiculosa, Rhizopus nigricans, Fusarium* sp.

The fungi selected for study were *Macrosporium cladosporioides*, Desm., and *Alternaria Brassicæ* (Berk?), var. *Citri*, Penz. Cultures of the former were prepared on onion leaves, and were eight days old when the measurements were made. Conidia of the *Alternaria* were obtained from a fine growth of that species which had appeared on a mandarin which had been under observation in a culture dish. Care was taken that all the conidia measured in the series were taken from the same culture, the same colony or centre of infection, and approximately at the same time.

Five hundred and forty *Macrosporium* conidia were measured, and 321 of *Alternaria*, making a total of 861 measurements. These measurements are tabulated in the table below, which also shows the frequency of occurrence of conidia of certain dimensions. It will be observed that the conidia of *Macrosporium cladosporioides* vary in length from 17μ. to 51μ., and that the limit of variation observed in *Alternaria Brassicæ*, var. *Citri*, was 9μ. to 44μ. The distribution of frequency in the two cases presents differences which are at once apparent, but they are more strikingly in evidence when the results are plotted. (See graph.)

SPORE-MEASUREMENTS OF *MACROSPORIUM* AND *ALTERNIA*.

MACROSPORIUM cladosporioides, Desm.			*ALTERNARIA* *Brassicæ* (Berk?), Sacc., var. *Citri*, Penz.	
Spore Length.	Frequency.		Spore Length.	Frequency.
9	0	..	9	1
10	0	..	10	0
11	0	..	11	4
12	0	..	12	1
13	0	..	13	14
14	0	..	14	6
15.	0	..	15	6
16	0	..	16	9
17	1	..	17	13
18	0	..	18	10
19	1	..	19	9
20	3	..	20	21
21	4	..	21	15
22	5	..	22	7

Spore Length.	Frequency.		Spore Length.	Frequency.
23	7	..	23	15
24	8	..	24	4
25	13	..	25	21
26	17	..	26	15
27	26	..	27	13
28	36	..	28	16
29	39	..	29	13
30	45	..	30	24
31	49	..	31	9
32	48	..	32	6
33	35	..	33	15
34	32	..	34	1
35	29	..	35	8
36	26	..	36	2
37	20	..	37	16
38	19	..	38	2
39	15	..	39	2
40	10	..	40	3
41	9	..	41	1
42	8	..	42	0
43	9	..	43	5
44	4	..	44	4
45	4	..	45	0
46	1	..	46	0
47	1	..	47	0
48	2	..	48	0
49	1	..	49	0
50	2	..	50	0
51	1	..	51	0
Total	540		Total	321

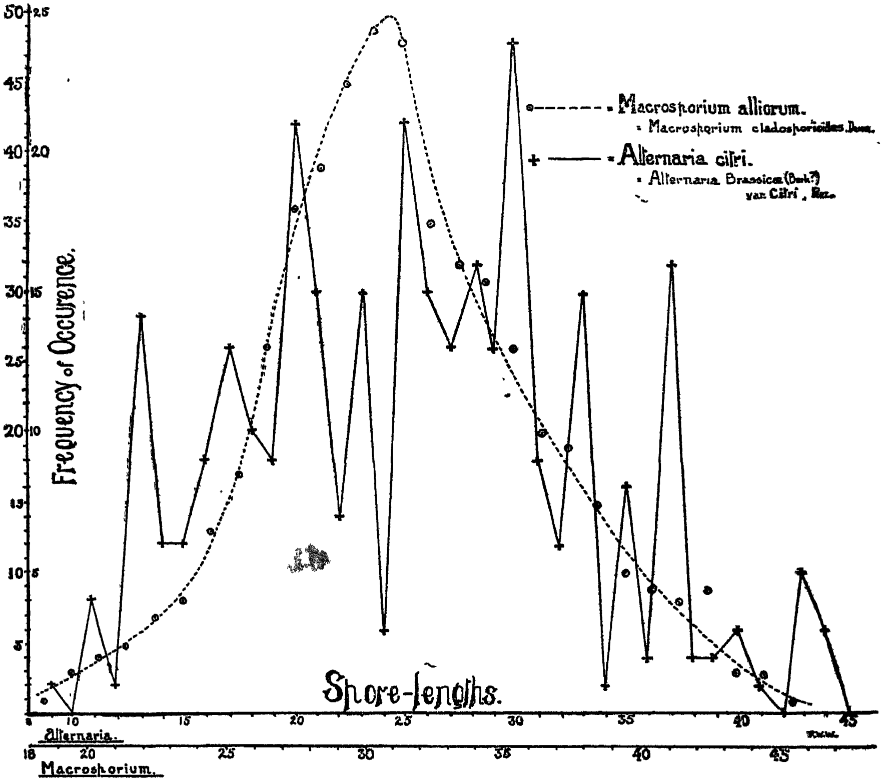
It will be clearly seen that in the case of *Macrosporium* a curve closely approaching the Normal curve is given. On the other hand, a most complicated figure is given by *Alternaria*. The interpretation of this graph of the measurements of *Alternaria* presents many difficulties, but it is probable that it represents a composite curve, consisting of a series of smaller overlapping and intersecting curves. Each of these smaller curves possibly corresponds to a conidium of fixed position with reference to the conidiophore, and in relation to the other conidia associated in the chain with it. The data accumulated are insufficient, however, to develop these details and confirm this suggestion.

CONCLUSIONS.

(1) That the variation in length of conidia of *Macrosporium cladosporioides*, Desm., is of the Normal type.

(2) That the distribution of frequency of spore-lengths in *Alternaria Brassicæ* (Berk?), Sacc., var. *Citri*, Penz., is irregular.

(3) That the morphologically identical conidia of *Macrosporium* and *Alternaria* may be differentiated by their respective variability. A study of variation in length of detached free conidia will indicate their solitary or concatenate origin.



A FURTHER NOTE ON THE TOPOGRAPHY OF LAKE FENTON AND DISTRICT,

NATIONAL PARK OF TASMANIA.

By A. N. Lewis, M.C., LL.B.

(With 2 Text Figures.)

(Read 8th May, 1922.)

Visits to the Mt. Field Plateau since compiling my previous paper (Lewis, 1921) have confirmed all the observations therein contained, especially as amplified and explained by Professor Griffith Taylor, D.Sc. (Taylor, 1921).

Lake Fenton is a paradox. It lies about 3,400 feet above sea level, almost at the top of a mountain ridge in the drainage basin of the Broad River. But the outlet, instead of draining down the slope of the hill to the river, breaks through the main ridge of the plateau in a gorge 500 feet deep into the Tyenna Valley. The lake is clearly of glacial origin, but the reason for the direction of its overflow requires further explanation.

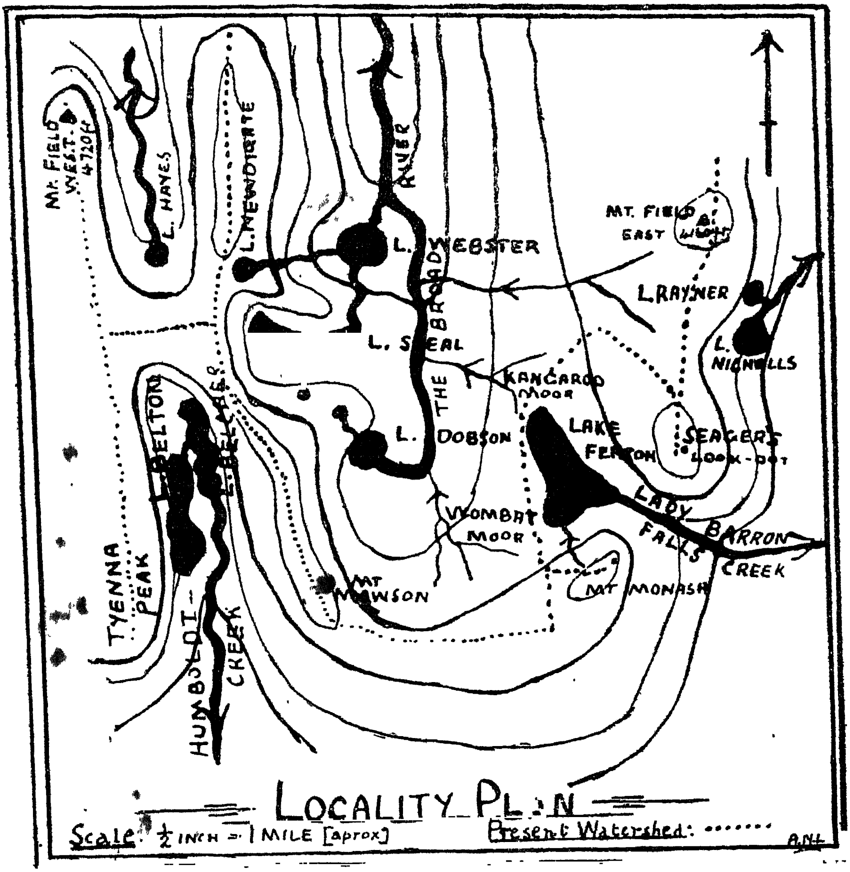
As I explained in my previous paper, the general watershed of the plateau runs in a westerly and north-westerly line from Mt. Field East, through Seager's Look Out, Mt. Monash, to the long ridge of Mt. Mawson. The Broad River drains this plateau, and has pushed its tributaries right to the edge overlooking the Tyenna Valley. On the southern side of the watershed the water that falls on the slope runs away in many mountain rills down to the Tyenna Valley, from which the land rises 3,000 feet very steeply to the edge of the plateau. The surface of the plateau slopes down gently to the northward from its southern edge, and the Broad River runs through its lowest valley.

Topographically, Lake Fenton belongs to the Broad River drainage basin. The land slopes away naturally from Seager's Look Out and Mt. Monash, across Lake Fenton to the Broad River Valley. But just at the site of Lake Fenton the main ridge has been cut through in a huge gap through which the lake empties itself, in exactly the opposite direction from that which appears natural.

The head of the Broad River Valley is here shaped like a horseshoe, cutting into the southern ridge of the plateau. Its southern end—its apparent source, although more water is collected elsewhere—lies in a cirque which has cut into the watershed. On the western side of its head lie Lakes Dobson and Seal in considerable cirques. On the eastern side at roughly the same level, and approximating in position to the two former lakes, lies Lake Fenton.

The problem of Lake Fenton is—"Why does its overflow not follow the main drainage flow of the plateau?

The solution is obviously to be found in the glacial origin of the lake, but in investigating this it can be seen that



the topography of the locality cannot be explained merely as an ordinary glacial valley blocked by a moraine.

In investigating the occurrence of glacial remains throughout the park, an observer cannot help being struck with the regularity with which the lakes occur in pairs or threes, one superimposed on another, at about an elevation of 300 feet. Dr. Griffith Taylor gives the clue to the cause of this phenomenon. (See particularly on this point Taylor 1921.) As he explains, the nivation layer or zone of maximum frost action has rested at one elevation for long enough to erode cirques in the hillside. Later, this zone has moved farther up the slope, where it has rested sufficiently long to erode a second series of cirques out of the older ones, and so on.

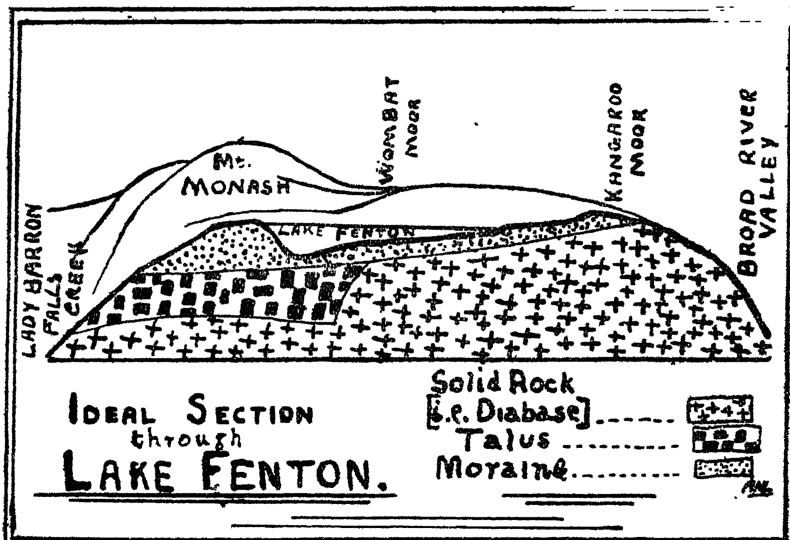
This superimposing of cirques has occurred with remarkable regularity throughout the area. In the Broad River Valley there is a trace of an old cirque, which I had not recognised previously, encircling the south-eastern, southern, and south-western shores of Lake Webster. It can be recognised by looking south from the outlet of this lake, in the very steep bank over which the Fenton-Webster track runs, and which runs west past the diabase cliffs mentioned at page 29 of my previous paper, including the bank over which the water from Lake Seal flows, to the wall-like side of Mt. Bridges, and farther north in the cliffs to the north-west of Lake Webster. This cirque has now been cut through and planed down near its centre, and vegetation has covered its slopes, but it was, apparently, in the early stages of the Pleistocene Glacial Epoch, the seat of the Broad River Glacier.

Later the nivation layer lifted some 300 feet, and was responsible for the erosion of the cirque at the head of the Broad, the Lake Dobson, and the Lake Seal cirques, and the cirque below Lake Newdegate. Here huge cirques were hollowed out all at about the same level.

Then the nivation layer rose 1,000 feet, and was responsible for the succession of small cirques in which the Tarns now repose, and for the other glacial ledges mentioned by Dr. Taylor. Also it rested on Mt. Field East at a similar level, eating into the plateau top until only a small residual 150 feet in height, the present summit, was left. The nivation layer then rose above these mountains.

This succession is followed out in every detail throughout in the field, as it is elsewhere in Tasmania, *e.g.*, Cradle Mountain, Mt. Jukes, Mt. Anne, and other glaciated plateaux.

In the National Park, Lake Nicholls, on the eastern slope of Mt. Field East, and Lake Belcher, under Tyenna Peak, are at approximately the same elevation as Lake Webster, and each lies in a cirque. From two to three hundred feet above each, another cirque has been cut, in which now lie Lakes Rayner and Belton respectively. Above Lake Belcher, on the opposite side of the valley to Lake Belton, and at the same elevation, there is a ledge which is probably an immature cirque. Above Lake Rayner the side of the mountain rises 1,000 feet nearly sheer to the top of the plateau, where the third phase has carved the Field East residual.



Above Lake Belton the ridge rises about the same distance to a small plateau, out of which rise Mt. Field West, Tyenna Peak, and three similar prominences, for a further 200 feet, as residuals from the original pre-glacial mountain plateau.

I am not yet prepared to say whether these three phases represent three ice invasions, and were separated by interglacial epochs of temperate climate, or whether they represent stages in the disappearance of the glaciers of the *last* ice invasion. But their occurrence was remarkably uniform throughout Tasmania, and can be traced in all glaciated regions of sufficient elevation.

The stages in the development of the present Lake Fenton were probably as follows:—Prior to the Pleistocene

times the line Field East—Seager's Look Out—Monash—Mawson, was a continuous ridge, unbroken by the Fenton gap, and thence the land sloped rapidly on the south to the Tyenna Valley, and gently on the north to the Broad River, which had by then captured the whole drainage of the top of the plateau.

During the earlier portion of the glacial epoch, the bottom of the Broad River was considerably deepened, and its sides made steeper. At the same time, the Lake Nicholls cirque, at the head of the Russell Falls Creek, was being eroded, and in the deeper bed of the Lady Barron Falls Creek another cirque was eating into the hillside. The preglacial creek bed had probably cut well into the mountain mass, and the intense frost action widened this valley, and cut a huge amphitheatre into the side of the hill.

As the nivation layer rose, and while it was cutting out the Dobson and Seal cirques and the cirque at the head of the Broad River, it was also cutting a similar cirque into the northern side of the ridge between what are now Seager's Look Out and Mt. Monash, and opposite the cirque at the head of the Lady Barron Falls Creek mentioned above. Thus two cirques cutting in end to end were gradually narrowing the rock wall that connected the last-named prominences.

Evidently the southern cirque was capable of more erosion, and was working deeper, than its twin on the other side of the ridge. As the ice age waned, this cirque at the head of the Lady Barron Creek shrank and operated at an elevation of about 300 feet above the floor of the original cirque; in fact, the nivation layer rose here, as in other places.

The southern cirque eventually ate right through the ridge, and invaded the drainage basin of the northerly flowing glaciers and streams. It carved a small basin about 100 feet deep, a mile long and half a mile wide, cutting deeply into the plateau mass, and thereby throwing the watershed a mile to the northward. It doubtless would have cut a cirque as imposing as the Lake Seal cirque, but for the fact that, since the old Broad River had eroded away the land surface, there was no rock face left from which to erode a cirque, and the result was a complete gap in the dividing ridge. The glacier probably vanished earlier than some others on the field, having eroded away most of the catchment area for its snowfield.

The larger and lower, earlier cirque can be clearly

traced circling the foot of Seager's Look Out and Mt. Monash at a point some half-mile south-east of the overflow of Lake Fenton. The whole face of this cirque is now littered with talus, and tremendous landslides of disintegrated diabase. The upper cirque is now filled by Lake Fenton, whose depth of 90 feet in one part indicates the depth to which this cirque has cut.

While the second nivation layer was carving out the floor of Lake Fenton, a small flow of ice moved down the valley for half a mile or so, melting near the present edge of the lake. This flow carried boulders, stones, and finer debris, which it dropped where it was melting. Much of this material probably came from the back of Seager's Look Out and the side of Mt. Field East, and a little also from the northern slopes of Mt. Monash. There were probably two ice flows, one from each side of the valley, as there is no catchment area to the north-west of the lake.

While the ice was carrying these boulders down from the neighbouring slopes, frost action was breaking down the walls of the earlier cirque below. These walls were covered with a broken wilderness of boulders tumbled down in the greatest confusion. Over the top of this mass the melting glacieret tumbled its load of clay and stones. The moraine thus formed obviously rests at its lower extremity on a talus of gigantic boulders, and by damming the valley and the enlarged head of the cirque it impounds the water of Lake Fenton.

It is difficult to define the boundaries of this moraine. At the edge of the lake the dam is undoubtedly a moraine, with some huge boulders, several 20 feet in every dimension, many small stones, but a larger proportion of clay. After a few hundred yards the boulders predominate, at least, on the surface. This is probably due to the action of rain on the edge of the slope washing away the smaller particles. A little farther down, and on a continuation of the same slope, the ground is covered by talus.

The side of Seager's Look Out has been subjected to rock slides on a tremendous scale at no very distant date, and the process does not appear to be completed yet. The old cliff walls of the cirque are rapidly disintegrating, and much of the talus so formed has covered the eastern edge of the moraine. The western limit of the ice deposits is undefinable on account of similar but less pronounced talus falls from Mt. Monash. So the only definite morainal deposit is a triangular-shaped bed, as shown in the diagram

of my earlier paper, extending from the shore of the lake a few hundred yards down the hill.

The point where the overflow from Lake Fenton (which only overflows in flood time) passes under the large boulders probably marks the end of the moraine and its junction with the talus over which it has been deposited.

Probably much water escapes through the moraine, as often the creek is running freely at a distance of three-quarters of a mile from the lake when no water is passing the overflow. Also the Lady Barron Creek is steadily cutting into the moraine, and has already cut a considerable groove into the embankment. On leaving the lake, the stream scarcely drops at all for 50 yards, then in the next 400 yards it drops about 200 feet. This leaves an extremely narrow ridge to be cut through by this very active creek before the lake will be entirely drained. Moreover, this ridge is composed only of loose earth and stones. The Lady Barron Creek will eventually drain Lake Fenton unless it is forestalled by a tributary of the Broad River in the following way.

As I have explained, Lake Fenton is lying on the south-eastern slope of the Broad River drainage basin. As it lies in a cirque cut into the Broad River basin from the other side of the divide, the lake still drains to the south-east through the watershed, but its north-western end rests merely on the old pre-glacial edge of the hill. This shore is bounded by a low moor, never exceeding 50 feet above the level of the lake. The surface of this moor slopes southwards towards the lake for about 300 yards back from the shore, then the land dips slowly, for a few yards, and then steeply in a north-westerly direction to the Broad River, 600 feet below, and not a mile away. A small tributary of the Broad River drains this moor, and rises within 600 yards of the *shore* of the lake.

This moor is littered with glacial debris. No solid rock is to be seen on the surface, and it is doubtful how far below the surface it lies. The tributary of the Broad is annually working its way through this, and capturing more and more of the drainage of Lake Fenton.

It will be a race between the Lady Barron Creek and the Broad River as to which drainage system will drain Lake Fenton, but there is nothing more certain than that the lake will be drained eventually by one of these streams. The Lady Barron Creek has reduced the level of the lake by about 10 feet since the glaciers receded, as lacustrine de-

posits can be traced at that height above the lake round the north-western and western shores. But as the lack of sediments flowing from the lake is a factor against the Lady Barron Creek, probably the Broad River will win eventually.

Then, again, the Broad River flows past the south-western end of the lake at a distance of less than a mile, and at least 100 feet lower. Each year its tributaries push farther and farther up Mt. Monash, diverting more and more water, and pushing back the narrow divide on Wombat Moor.

Lake Fenton in the future will be quite drained, and is to-day an excellent example of a "Wind-Gap" in the making. It also provides an example of the capture of portion of the drainage of one river system by another, the capture being effected not by water, but by frost and a glacier, a form of river piracy which does not appear to have been much noticed in Tasmania.

I have little further information to bring forward about any of the other lakes in the park, although much field work yet remains to be done, and there are many problems yet awaiting solution.

The Tyenna Peak-Mt. Field West ridge appears to be a sill of diabase which has forced its way horizontally west from the main plateau, and now overlies beds of Knocklofty series sandstone. The valley in which the Lakes Belcher and Belton lie appears to have cut right through the diabase, and enlarged itself in the softer sandstone below. The floor of the valley is covered with morainal material, which makes it difficult to tell whether the sandstone extends right up to the shores of the lakes, but a mile below the lakes the floor of the valley consists of this rock.

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MACQUARIE ISLAND AND ITS FUTURE.

By

SIR DOUGLAS MAWSON, KT.B., D.SC., B.E., O.B.E.

Plates I.-VII.

(Read 12th June, 1922.)

Macquarie Island has recently assumed an importance in the public mind far beyond that suggested by its modest proportions. This distinction emanates from its wonderful population of quaint Subantarctic* life. From the days of its discovery in the year 1810, it has ever been remarked by visitors to its shores as a wonder island of marine bird and seal life.

The hand of man has, alas! cast a shadow over its myriad inhabitants, and wrought irreparable havoc; but this devastation is not yet so complete as that of the more accessible islands to the south of New Zealand, where the destruction of the native fauna is much further advanced.

In the consideration of its animal population, the island is quadruply unique in the Australasian seas. Firstly, for the abundance of the life; secondly, for the variety of species frequenting its shores, some, like the King penguin and the Sea-elephant, breeding nowhere else in Australasian waters; thirdly, for the fact that it is the only speck of land in the vast expanse of ocean to the south of Australasia and New Zealand between latitude 52 degrees south and the Antarctic Circle, and is consequently the only possible breeding place for such life in those seas; finally, for the fortunate circumstance that up to the present man has not completely wrecked nature's handiwork, though certain species of life formerly abundant are now extinct, and others so greatly reduced that they are in danger of complete extermination.

In these days the nations of the world are taking council. Realising the economic and scientific value of perpetuating, as far as practically possible, the varied forms of life which, in association with man, populate mother earth, they are making more and more provisions to ensure the continuance of species.

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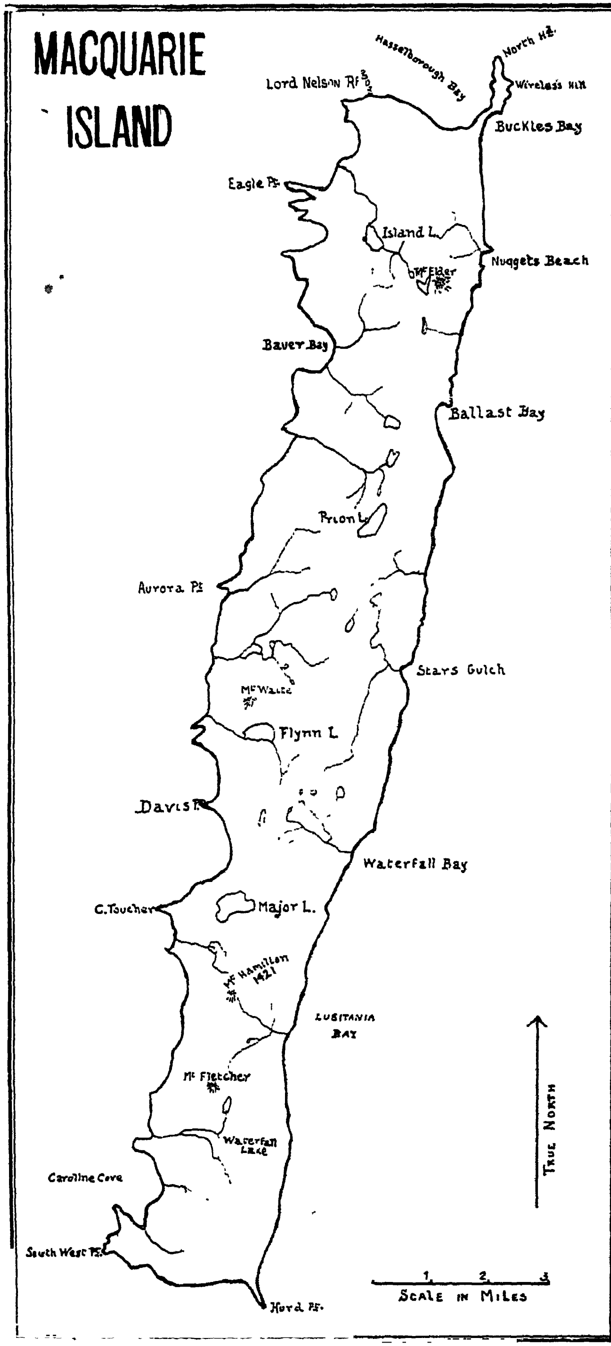
*This spelling, in preference to "sub-Antarctic," is adopted in conformity with the decision of the Philosophical Institute of Canterbury, N.Z., in connection with their Report on the Subantarctic Islands of New Zealand, published in 1909. It is thus made a definite and specific regional name.


MACQUARIE ISLAND
Hasselborough Bay
North Hd.
Lord Nelson Rf
Wireless Hill
Buckles Bay
Eagle Pt.
Island L.
Nuggets Beach
Mt Elder
Bauer Bay
Ballast Bay
Prion L.
Aurora Pt.
Stars Gulch
Mt Waite
Flynn L.
Davis Pt.
Waterfall Bay
C. Toucher
Major L.
Mt Hamilton 1421
Lusitania Bay
Mt Fletcher
Waterfall Lake
Caroline Cove
South West Pt.
Hurd Pt.
True North
1 2 3
Scale in Miles

In illustration may be mentioned National reserves where indigenous life is afforded absolute protection, as, for example, Laysan Island, in the Sandwich Group, which is entirely set aside by the United States Government as a sanctuary and breeding ground for marine birds; also our own reserves in the several States of the Commonwealth, where areas are set aside for the indigenous fauna. At other times protective measures are adopted in relation to the exploitation of certain animals where there is a danger of indiscriminate slaughter leading to the extermination of "the goose that lays the golden egg." As examples of this kind may be mentioned, firstly, the International legislation controlling the fur seal industry of the Pribyloff Islands, where alone there now remain extensive rookeries of fur seals; secondly, the control effected over the whaling and sealing industry of that part of the Antarctic and Sub-antarctic that falls within the jurisdiction of the Falkland Islands and Dependencies.

In both cases these latter restrictions refer to very lucrative industries, which, but for the passage of wise legislation, would ere this have been a thing of the past. Prior to the inauguration of protective measures, the days of the fur seal of the North Pacific were numbered; each successive year saw the rookeries greatly reduced. But in the long period that has elapsed since indiscriminate slaughter gave place to a rational treatment of nature's bounty, the numbers of the fur seals resorting to the Pribyloff Islands during the breeding season have at least remained undiminished. It would appear that fur seals were relatively as numerous(1) in the Southern seas in past times as their kindred in the Sub-Arctic; but the slaughter was carried on with such vigour and without discrimination in the days before measures for regulating the traffic were thought of, that they have been practically exterminated, and thereby a great and valuable trade lost to the Southern Hemisphere.

So it is with all the larger wild animals of the world; they are rapidly diminishnig in numbers, and this is especially so in the case of animals yielding products of commercial value. It is only by the adoption of strict control over the slaughter that such can hope to be preserved. In no instance is this better marked than in the case of the whale.

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(1) There is record that 320,000 fur seals were taken from the South Shetland Islands in the two seasons 1820-21. From Macquarie Island it is likely that not less than 180,000 skins were taken between the years 1810-13.

Referring to whaling, Dr. Harmer says(2): "In every "case the history of the operations has been identical, the "period of prosperity with which they opened having been "succeeded by a notable fall in the numbers caught, so that "in most of the localities where whaling was once profitable "the industry has become a thing of the past."

In the Arctic Regions where the Right Whale has been hunted for a very long period, its numbers have now reached a vanishing point.

Antarctic whaling began in earnest in the year 1904, when the vast schools of finner whales were attacked by modern methods, with bases at the island of South Georgia and at the South Shetland Islands. Dr. Harmer(3) says: "At both these localities whaling has been extraordinarily "successful, and in a single year the total catch of both "together has exceeded 10,000 whales; a number which "should be contrasted with 1,437 Greenland whales captured "in 1814, a year described by Scoresby as a specially good "one."

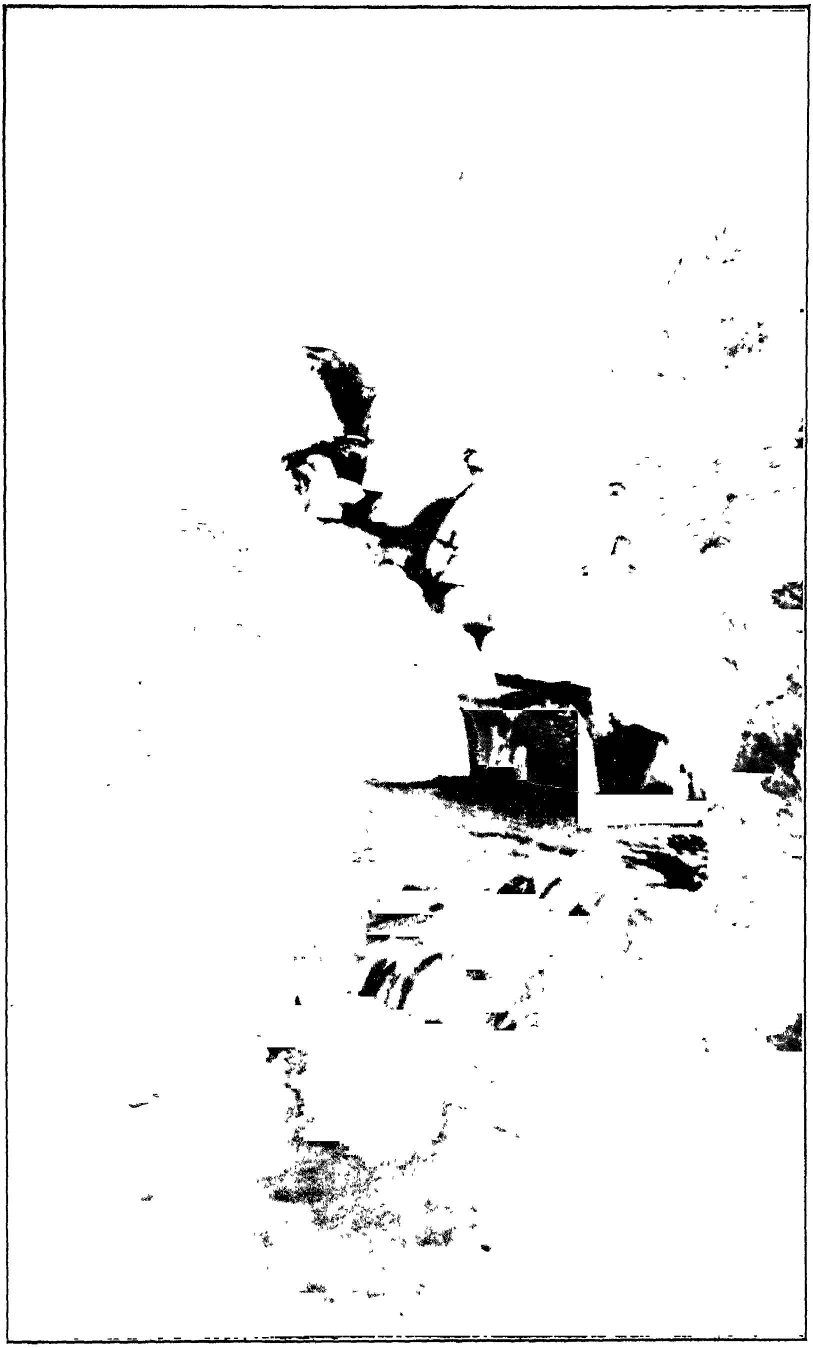
But already the whales are becoming scarcer in those seas, which diminution would be the more accented but for certain restrictions imposed by the administration. The falling off is specially noticeable in the case of the Humpback whale, which constituted 90 per cent. of the catch in the years 1910-12, but had diminished to less than 10 per cent. in the season 1916-17.

In the case of the whales, which animals live their entire lives in the sea, there is far less chance of extermination than in the case of the seals and penguins, which spend a part of the year, the breeding period, ashore; this is especially so with the Antarctic life which has never been hunted by man or predatory land mammals, and is consequently an easy prey.

It would be an easy matter, by the exercise of uncontrolled slaughter over a period of several years, to wipe out the Sea-elephant and penguin life in Macquarie Island. Once gone, it would be practically impossible to regenerate the lost fauna, and the feasible project of perpetual economic exploitation, whilst at the same time maintaining their numbers, would be gone for ever. With the extinction of the seals and penguins goes the economic future of the island.

(2) Scientific Development of the Falkland Islands and Dependencies, by Dr. S. F. Harmer. Jour. Geog., Vol. LVI. (1920), p. 61.

(3) *Ibid.*, p. 62.



A MACQUARIE ISLAND GULLY. (Henderson, photo.)

It is, therefore, only common sense that postulates that the very least that should be done in the case of Macquarie Island, if killing is to be permitted, is the passage of legislation to secure the maintenance of its animal population by limiting the slaughter. But without Zoological advice and proper oversight on the ground such administration could never expect to be effective.

Considering its small size and its absolutely unique position as the *sine qua non* for certain Subantarctic life in our Australasian Quadrant, I am convinced that the wisest course is to reserve Macquarie Island as a sanctuary and breeding place, interfering as little as possible with the balance of existing life.

How this protection can best be secured necessitates a divergence for the brief consideration of its geographical features(4) and administration.

Macquarie Island is situated about 900 miles S.S.E. of Hobart as a solitary speck in the stormy seas of 55 deg. South Latitude. In actual miles it lies nearer to New Zealand than to Tasmania, but on account of the prevalence of strong westerly weather, it is easier of approach from the latter. For the same reason the direction of New Zealand is the more favourable to navigation for the return voyage. On these grounds, voyages to the island in sailing craft would be best included in an itinerary between Hobart and New Zealand. In the case of power-driven craft, however, the existence of the Auckland Islands, with good harbours, situated in an intermediate position, rather favours communication backwards and forwards to New Zealand.

As it is placed on the map, Macquarie Island does indeed suggest a genetic connection with the New Zealand Archipelago. It has the appearance of being an outlying member of the company represented by the Auckland Islands, Campbell Islands, and Snares Groups. But the latter all stand in comparatively shallow water upon the New Zealand platform, from which the Macquarie Island ridge is separated by a deep submarine trough.

Since its earliest days it has been attached as a dependency of Tasmania, though until recently few Tasmanians were aware of their charge. In the year 1890 an endeavour was made by the New Zealand Government to annex the Island. Upon discovering that it had been attached to

(4) For fuller particulars refer to "Macquarie Island" by D. Mawson. Proc. Roy. Geog. Soc. Australasia (S. Aust. Branch), Vol. XX., pp. 1-15.

Tasmania for some 70 years past, efforts(5) were made to have it transferred to New Zealand, but without success.

As a result of this awakening to the existence of Macquarie Island the Tasmanian Government passed regulations(6) prohibiting the killing of seals of any kind. Henceforth a permit was needed granting permission to kill.

There are rumours that representatives of the New Zealand Government have again recently probed the ground to ascertain whether the Tasmanian Government still holds the same opinion with regard to the transfer.

Macquarie Island is somewhat over 20 miles in length, and not exceeding 3½ miles in width, with the long axis nearly north and south across the direction of the prevalent winds. It represents the backbone of a ridge which can be traced for a long distance beneath the sea, reappearing 8 miles to the north in the Judge and Clerk rock, and again 20 miles south from the southern extremity in the Bishop and Clerk, another isolated spray-swept outpost.

The land rises steeply from the sea except here and there along the coast, where strips of a boggy, raised beach platform intervene. The summit of the island is an undulating plateau at almost 1,000ft. above sea level, dotted at intervals with lakelets at least partly of glacial origin. Evidence is everywhere afforded that the island was overwhelmed with an ice sheet in the recent past, though no permanent ice now remains. The rocks are chiefly volcanic—basic lavas, agglomerates, and cinder beds.

The climate in terms of our own, here in Australia, is rather a miserable one. The mean annual temperature ranges between 38 deg. F. and 40 deg. F., and is kept surprisingly uniform throughout the year by reason of the great body of the surrounding ocean. The almost continuous strong westerly winds, combined with fogs and driving rain, result in a climate almost, but not actually, glacial.

As to the vegetable and animal life(7) sustained by this comparatively inhospitable spot, little can be said of the former beyond that the island supports no tree growth, the only vegetation being rank tussock grass, Kerguelen

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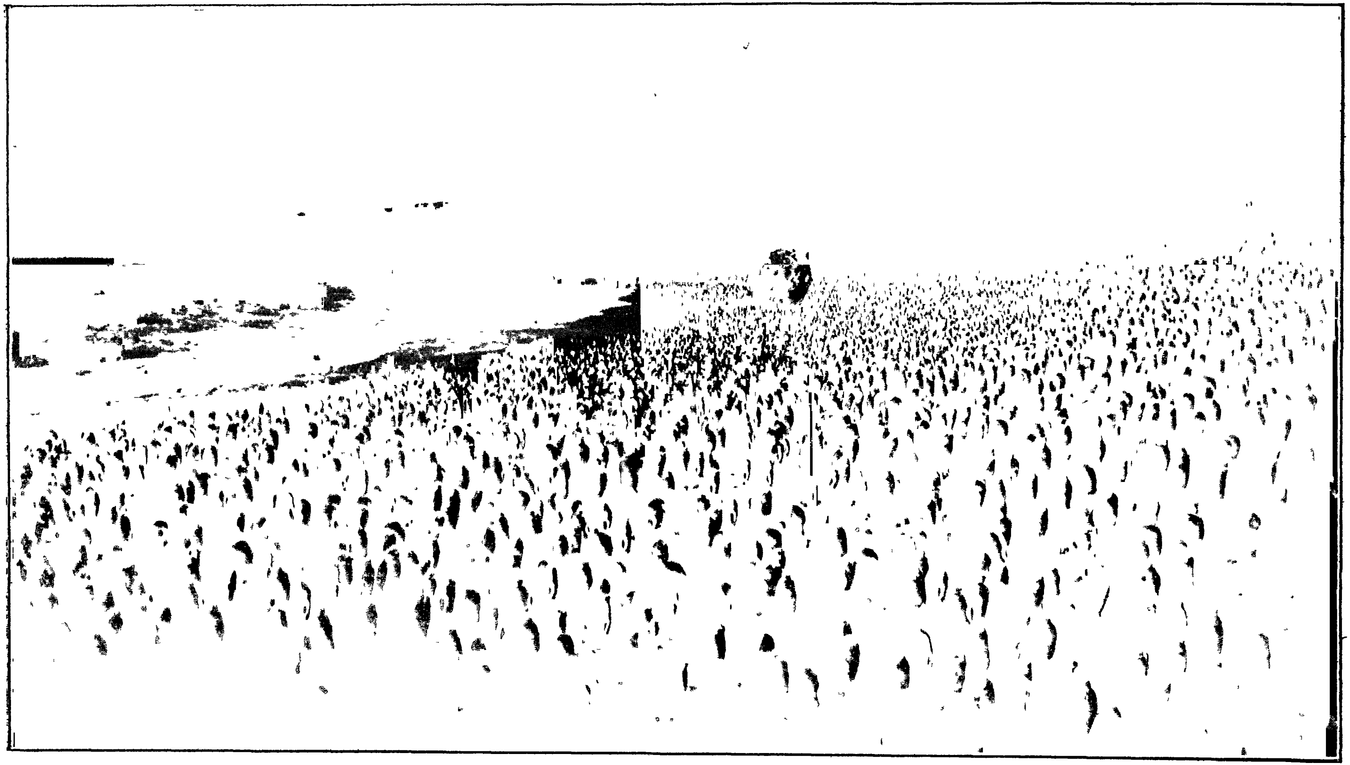
(5) See N.Z. Parl. Papers App. to Journal of House of Reps., Sess. II., 1891 A. -5 in cont. of A. -5 1890.

(6) Under Section 12 of the Fisheries Act, 1889 (53 Vict., No. 11); proclamation issued in 1891 by the Tasmanian Government, and published in the Hobart *Gazette*, 21st Apl., 1891.

(7) For a detailed account refer to "The Home of the Blizzard," by D. Mawson. Heinemann and Co. 1915.



THE NUGGETS BEACH, MACQUARIE ISLAND.

(Henderson, photo.)

cabbage, a variety of ferns, moss, and such like. On the other hand the animal life resorting to those shores is of the greatest possible interest, both on account of the wealth of population and the interesting forms represented.

The beaches are still well stocked with that largest of all the seal tribe, the sea-elephant, the bulls of which quite commonly attain a length of twenty feet. Fur seals, formerly so numerous, are now practically extinct. The only other variety of seal haunting those shores is the sea-leopard, which preys on the other seals and the penguins.

Of bird life there is an amazing population, remarkable for its numbers, its variety, and the lesson that it teaches in adaptation to environment. They are principally marine forms; albatross, petrels, and the like on the one hand and penguins on the other. Of land forms, there is little to say beyond the presence of a species of duck frequenting the boggy flats; the former existence in great numbers of a flightless parakeet now extinct; and the presence of innumerable Maori hens (Wekas), which have multiplied from a few specimens brought down from New Zealand by sealers many years ago.

This is no occasion for detailed reference to the wonderful penguin population, beyond stating that four species regularly resort to the island in the breeding season, namely, the King, the Royal, the Victoria, and the Gentoo. The noble and handsome King penguin is one of the worst sufferers from the scourge of the sealer, and is in imminent peril of complete extermination. The Royal penguins are still found congregating in rookeries of hundreds of thousands in several localities, notwithstanding that their numbers have been heavily drawn upon by the sealers for many years past. The Victorian and the Gentoo penguins are less attractive to the oil seekers, being smaller in size and never herded together in the same numbers.

The story that this bird life teaches of evolutional change along lines fitting it for existence under the special conditions of that great wind-swept belt of the southern seas, is something to be particularly remarked upon.

Records concerning the green parakeets which existed in great numbers in the earlier years of last century indicate that, in all probability, they were descended from a normal parakeet stock transformed to an almost flightless condition by long existence under the wind-swept and treeless environment. Though not wingless, the bird was gradually losing the use of the wings, under conditions

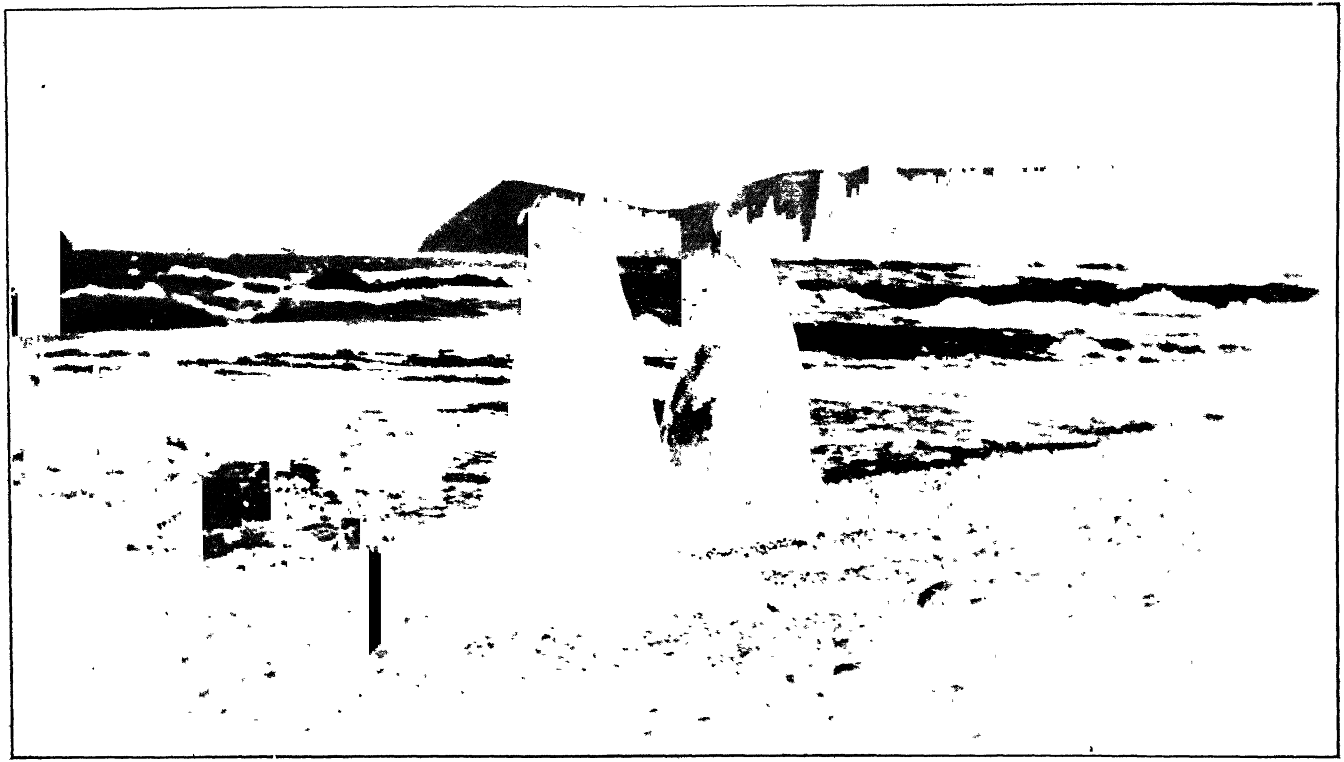
where it was doubtless safer to keep to the ground than battle on the wing against the ever-prevalent gales.

The case of the specialisation exhibited on the one hand by the penguins, whose wings have degenerated to mere swimming appendages, and on the other by the albatross class of birds, which plane on the wind without flapping their wings, appears to be the direct outcome of an evolutional development to meet the possibilities of an existence in that great wind-swept region encircling the Globe northward of the margin of the ice belt. The region between 40 deg. and 60 deg. south latitude is famous for its ever-blowing westerlies. The existence of these winds in their present strength hinges upon the continuance of the great heat engine of the Antarctic ice-cap. That great ice-cap was greater still in the recent past, pushing out farther to the north, and therefore doubtless more efficient than it is to-day in keeping the southern atmosphere constantly circulating. The roaring forties and the screeching fifties may have then been even more formidable than is the case now.

At least we can be sure that these winds have continued to blow around the earth in these latitudes for a very long time in the past; under which conditions the bird life would find no profit in flight by flapping the wings. The two evolutional alternatives to meet the conditions would be either to abandon flight altogether, and become a penguin, or else to master the art of planing on the wind, thus turning the very power of the storm to account, as do the albatrosses and petrels. It is significant that the natural range of the penguin and the albatross is just this great storm-swept belt around the earth. Macquarie Island is the very soul of the tempestuous south, and the natural home of its specialised life.

Now turning to the history of human occupation, we find that the island has been visited from time to time since the days of its discovery by vessels in search of seal pelts and blubber oil. The rush during the first three or four years after its discovery served to practically exterminate the fur seal. Thereafter visitations were less frequent, though the blubber oil industry appears to have been revived on occasions during last century.

Apart from the damage to fauna directly wrought by these sealers, they are indirectly responsible for irreparable losses arising out of the introduction by them of the domestic cat. The wild descendants of these felines are scattered about the island spreading destruction amongst the



BULL SEA-ELEPHANTS, MACQUARIE ISLAND.

(F. Hurley, photo.)

smaller forms of bird life. The final extinction of the ground parakeets is ascribed to the depredations of these cats. They are also a factor to be reckoned with in the depletion of the smaller petrels.

Short references to the wonderful bird population have been recorded at intervals during its history by exploring expeditions(8), which, in passing, made brief calls at the island. But no proper chart or detailed survey of Macquarie Island was made known until the work of the Australasian Antarctic Expedition in 1911-14. Up to this latter campaign, the only important contributions to the Natural History(9) came from Professor J. H. Scott and Mr. A. Hamilton, of the Otago University, who made short visits there; the former in 1880 and the latter in 1894. These visits resulted in the publication of a general description of the plant and animal life, and drew attention to that fascinating field for further observations.

This brief record is not complete without some reference to Mr. Joseph Hatch's association(10) with the island. For many years past he has conducted a blubber oil industry, with headquarters at Invercargill. Every year parties of men have been sent down to the island to kill the sea-elephants and penguins and render them down for their oil. This was then brought back in casks to Invercargill to be refined before marketing. The slaughter of about 700 sea-elephants and some 300,000 Royal penguins would, so far as one can ascertain, be considered a fair season's work at Macquarie Island.

This trade was never attended with any proper financial compensation for the toll of life involved. As a result Mr. Hatch has passed through a series of financial crises, and, indeed, the nominal rent of £20 per annum for the lease of the island remained for years unpaid. This is an indefensible position for anyone seeking to justify the great slaughter.

More recently, in 1914, the trade was revived with greater vigour, Mr. Hatch having interested additional capital in the venture, which was then floated off under the title of "The Southern Islands Exploration Company." From

(8) Bellinghausen, 1821; Wilkes, 1840; Scott, 1904; Davis (Shackleton Expedition), 1909.

(9) See: Scott, Repts. A.A.A.S. Vol. III. (1891), pp. 226-227. Proc. N.Z. Inst. XV., pp. 484-938. Hamilton; Proc. N.Z. Inst. (1894), pp. 559-578.

(10) He has operated at Macquarie Island at least as early as 1891.

this date the business was pressed with still greater energy under a lease renewable annually at the discretion of the Tasmanian Government for the sum of £40 a year. During this period much of the crude oil was returned to Hobart and refined there.

This lease continued between 1915-1918, but, even with the high war prices ruling for the products, the Government experienced difficulty in collecting the rent. In connection with the operations of this company, a further extension of lease for one year was granted in 1918 to enable them to remove their plant, which operation was apparently never effected; doubtless, for the simple reason that value of the said plant did not warrant its removal.

The proposition had not been a payable one, and the company had gone into liquidation(11). Yet there were those who had the temerity to be again contemplating a lease of the island, with a view to further prosecution of the blubber industry. This is surely unjustifiable slaughter, though Mr. Hatch has recently delivered propaganda lectures(12) in Tasmania and New Zealand with a view to substantiating a claim for a further lease. The very interesting life of the island lends itself as a subject for a lantern lecture, and, if skilfully handled, can doubtless be made very good propaganda to draw the sympathies of the audience to the lecturer. In this way must be explained the psychological anomaly of some, at least, of these audiences, which, after admiring the views of the wonderful animal life, have ended by expressing confidence in the very gentleman who, for practically thirty years past, has made it his business to slaughter annually vast numbers of the island population.

The argument which counsels the withholding of a lease of the island for the prosecution of the blubber oil industry is that, unless conducted on a scientific basis and under proper control, the annihilation of certain species will be quickly accomplished. It has been asserted that the kill-

(11) See the Hobart *Mercury*, 26th November, 1920.

(12) I regret that Mr. Hatch, on account of my efforts to maintain the island as a sanctuary for the fauna, has, in the course of these lectures, according to press reports, found it necessary to make disparaging and wholly unfounded statements regarding myself. Contrary to Mr. Hatch's assertions, the establishment of the Australasian Antarctic Expedition station at Macquarie Island was a great boon to his commercial operations. Twice in the period of the two years the Expedition rendered signal assistance to his undertaking at some financial loss to ourselves. On the other hand, Mr. Hatch never went out of his way at any time to assist our operations.

Judging by the records of other expeditions, we were not alone in these unsatisfactory relations with the gentleman.

SKUA GULLS, MACQUARIE ISLAND. (R. L. Blake, photo.)

ing as conducted by the sealers does not reduce the numbers. This is obviously untrue, though the reduction in numbers over a short period may not be apparent where the original number is very great, as is the case with the Royal penguins.

The life frequenting the island at the date of its discovery was unquestionably a balanced population at its full capacity. Any new factor of destruction entering that metropolis must assuredly, by continued exercise against any members of the community, effect a reduction in numbers. Exacting a constant annual toll, the population will decrease in continually increasing proportion. This principle must obtain, though in practice somewhat modified by the operation of several contributing influences.

The effect of past sealing operations at Macquarie Island has been disastrous to its economic and scientific interests, a statement which is quite indisputable.

The sealers first attacked the most valuable of its animals, the fur seal, making a clean sweep of these, so far as they were able, in the first three or four years. Odd survivors of that senseless butchery, being the special mark of all subsequent sealers, were never afforded that respite necessary for the recuperation of their numbers.

The flightless parakeets[13], which are recorded on the island up to the year 1880, were extinct by about the year 1891. The early sealers killed these in great numbers, as they were reported particularly good to eat. The final extinction must have been due to the ravages of the wild domestic cats.

The sea-elephants, fortunately, still maintain themselves in considerable numbers, though greatly reduced, if we judge by early reports. Several fortunate circumstances have contributed to the survival of this monster: In the first place, much of the coastline is not economically accessible to blubber oil operations, and it is on the stormy western coast where the elephants now principally congregate; secondly, it is certain that in these latitudes sea-elephants often travel far, so that accessions from distant Kerguelen and other resorts are to be reckoned with; finally, on account of its immense size—therefore blubber value—in comparison with that of the female, the bull elephant is naturally the particular mark of the sealer, and a considerable toll exacted amongst the numbers of the bulls should have no

(13) Other less conspicuous finch-like land birds appear to have suffered extinction also in like manner with the parakeets.

serious effect in the birth-rate in the case of such polygamous animals.

The next creatures to attract the attention of the oil seekers would be the handsome King penguins at Lusitania Bay, the only rookery of this the largest of the Subantarctic penguins, that now exists(14) in the Australasian seas. The oil yield of this penguin of course exceeds that of the smaller species, hence the persecution these birds have suffered, resulting in the dwindling of the rookery to a mere handful—perhaps a few hundred birds—at the present day. They are indeed in serious peril of extinction in the near future, though the sealers have ceased to trouble them of late years, beyond levying a not inconsiderable toll upon their eggs on account of their palatability.

Compare this state of affairs with the position in the year 1894 as reported by Mr. A. Hamilton(15).

"At Lusitania Bay we went in and dropped anchor "within a few hundred yards of the shore in 15 fathoms of "water." . . . "We had to amuse ourselves by watching "the thousands of King penguins sporting around us. . . ."

"The factory at Lusitania at the King penguin rookery "is not now used; the great heap of refuse testifies to the "great numbers of the birds destroyed. No impression, "however, seems to have been made on the numbers occupy-"ing the beach, as every available place seemed full of "birds."

"The interest and the novelty of the sight of thirty or "forty acres of penguins (King) made up for the deafening "noise and the fearsome smell. . . ."

"Nearly the whole of Lusitania Beach, over half a mile "in length, is occupied by King penguins."

The lamentable dwindling of these once countless birds has all taken place within a period of twenty years, during the continuance of Mr. Hatch's connection with the island.

The Royal penguins, which for some years past, in normal seasons, have been levied upon to the extent of 300,000 birds per annum, have not given unmistakable evidence of this drain upon their numbers. At least this was so in the year 1913. Fortunately for them, several very large rookeries occur at other parts of the island inaccessible to the sealers, and these must help to maintain the numbers at the

(14) Mr. H. Hamilton, of the Australasian Antarctic Expedition, found abundant bones of the King penguin on the spit at the north end of the island, indicating the site of another rookery apparently wiped out during the reign of tne sealers.

(15) Proc. N.Z. Inst., 1904, p. 562, *et seq.*

VICTORIA PENGUINS, MACQUARIE ISLAND.
(H. Hamilton, photo.)

Nuggets rookery, where the boiling down works is situated. Viewed in the light of what has happened elsewhere, it may be reasonably predicted that under the continued pressure of a steady drain on the rookeries by the sealers, a very serious decline in their numbers must be expected after the lapse of a few years.

What has been said is sufficient to show the practical inadvisability of leasing the island for the indiscriminate killing of the fauna.

The question presents itself—How can the island be turned to permanent profitable account consistent with maintenance of the animal life?

Inquiry into the possible future of Macquarie Island suggests several alternative courses, which will be considered *seriatim*.

1. *An unrestricted lease*, such as has been granted in the past. There is no need to add more to emphasise the unwisdom of this policy.
2. *A limited lease*, defining conditions of occupation framed in the interests of the general fauna.

   A. With license to slaughter each year a stipulated number of bull sea-elephants and Royal penguins. The numbers considered safe to kill would be a matter for agreement annually by a board of advice, of which one member at least would need to be a zoologist. Such a board would require to be well informed as to the condition of the rookeries each season, a stipulation that would call for an annual inspection.

   In order to cover the expense of such administration, the rent would need to be a figure far above that recently demanded. Under this circumstance it is very questionable whether anyone would be found willing to invest in the venture, in view of past experience where operations working under more favourable conditions have ended in failure.

   B. With absolute protection for the native fauna, but granting rights for fur-farming or grazing rights for sheep, cattle, or reindeer.

   On first consideration much might be expected by developing the island on these lines, but, knowing its limitations, I would be very chary to recommend such undertakings as profitable.

The artificial rearing of black foxes is now a settled industry on Prince Edward Island. Good skins sometimes fetch many hundreds of pounds sterling, and £1,000 for a single animal as prize stock for breeding purposes is not considered an exorbitant charge.

Sheep(16) have been fattened on the island, and if the Romney Marsh variety recommended by His Excellency Sir William Allardyce(17) were introduced, they should thrive satisfactorily. Success might also attend the introduction of Highland cattle, or even reindeer. The latter recently introduced into the Island of South Georgia are reported to be doing well, and increasing in numbers.

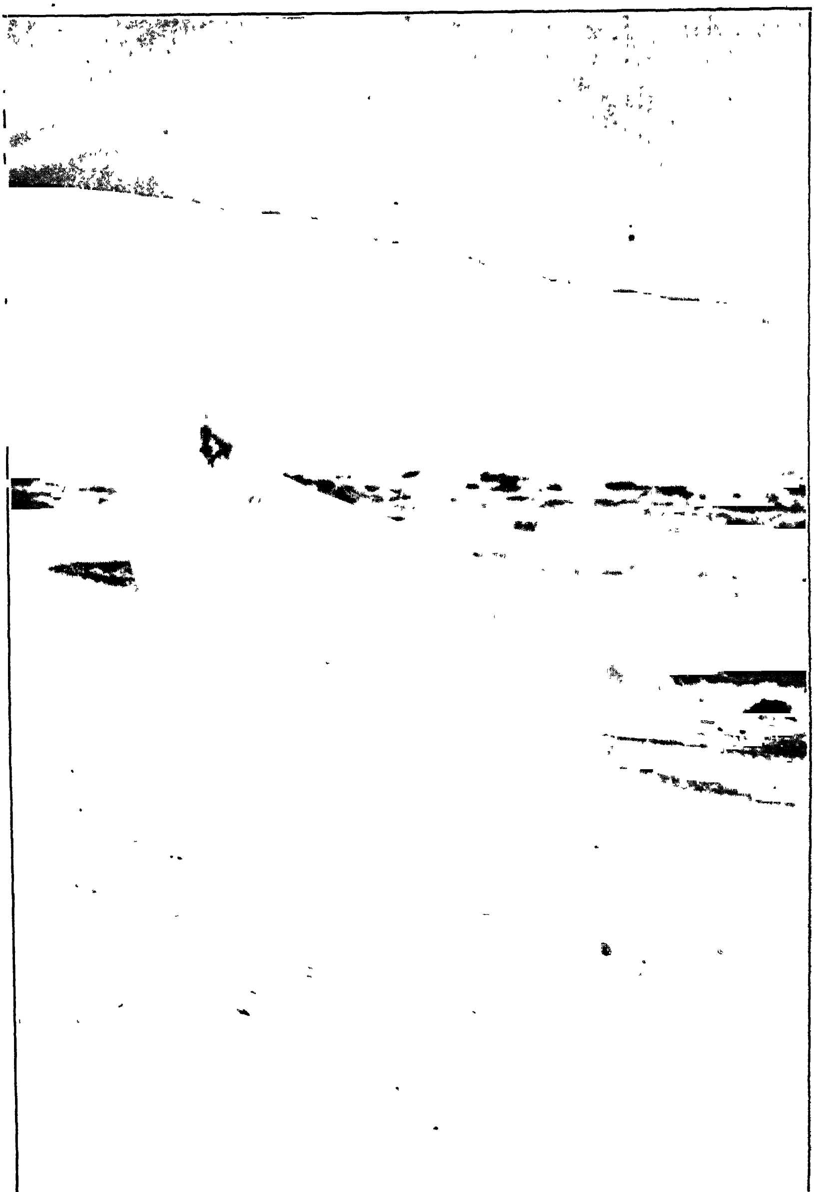
But in estimating the grazing value of the island, the map area is no indication of the available pasture land. The whole summit of the island is either bare of vegetation or at the most supports only mosses and lichens. The steep hillsides, leading from the sea, carry a very considerable clothing of tussock grass and other vegetation, and present possibilities for grazing. The best fodder, including abundance of Kerguelen cabbage, is that on the flat strips of raised beach along the coast, but much of this is so boggy as to be more suited for ducks than for cattle.

The occupation of the island for any such grazing purposes would undoubtedly have some effect upon the native fauna and flora; for example, the burrows of the prions would be trampled in by the presence of anything like herds of these animals.

3. The permanent withdrawal of the lease and the proclamation of the island as *a National Faunal Reserve.* To my mind, this is the best course to pursue, in view of its advisability from a scientific standpoint, and in the face of the great difficulty

(16) See: "Report on Macquarie Island," by A. C. Tullock: Parl. Papers No. 7; Hobart, 1916. Also in "The Home of the Blizzard." Heinemann and Co. 1915.

(17). Furnished with a long experience of the Falkland Ids., His Excellency the Governor of Tasmania could not be better equipped to advise on the future of Macquarie Island, where many of the natural conditions are identical.



BULL SEA-ELEPHANT, MACQUARIE ISLAND.

(Henderson, photo.)

of economically exploiting an island hampered by such natural deficiencies as absence of harbours, remote situation, absence of fuel, semi-glacial climate, etc.

To make such a sanctuary efficient, some form of supervision is called for, if for no other reason than to prevent poaching(18).

Such supervision, unfortunately, necessitates expenditure. If the island were placed under Commonwealth control(19) it would be an easy matter for a gun-boat or lighthouse vessel to make an annual visitation, at no great additional expense to the community.

Considering the desirability of making any scheme as self-supporting as possible, the practical solution of this problem may lie in the maintenance on the island of a small Government party, whose chief work might be to maintain the "wireless" meteorological station, to kill limited numbers of bull sea-elephants for skins and oil, possibly develop a penguin egg industry for dried egg substance, attempt to re-establish the fur-seal, and to run a few sheep and reindeer sufficient at least for their own requirements.

Should these operations be carried out under adequate control, the result ought to be satisfactory, as far as the question of the fauna is concerned, and the financial return perhaps sufficient to pay expenses.

(18) Mr. Hatch has reported that sealing vessels from Newfoundland have in recent years been known to make raids upon the island. With the two boiling down plants left on the island, the inducement to poachers will be enhanced.

(19) In 1918 conversations took place between the Tasmanian and Commonwealth Governments on this matter, resulting in an offer of the island to the Commonwealth Government for a faunal reserve on the basis of 5s. an acre, amounting in all to a sum of £14,000. But as the value of the island, judging by the rent (which rent of £40 per annum included the right to wipe out practically the only asset the island possesses) asked, had been previously valued at less than £1,000, nothing further eventuated.

EXPLANATION OF PLATES.

Plate I.

Map of Macquarie Island.

Plate II.

Luxuriant herbage in a gully on the south-west side of the island. The waters of the highland lakes descend by rapid and deeply-entrenched courses to the sea.

(Photo. by F. J. Henderson.)

Plate III.

The Nuggets Beach at Finger and Thumb Point. The shore is thronged with Royal Penguins (*Catarrhactes schlegeli*), which come and go between the sea and their rookery inland, high on the hill slopes.

(Photo. by F. J. Henderson.)

Plate IV.

Bull Sea-elephants in combat, a not unusual sight during the months of spring. Such frays continue until one or other is vanquished, sometimes lasting the whole day long.

(Photo. by F. Hurley.)

Plate V.

Macquarie Island Skua Gulls (*Megalestris antarctica*) feeding on the carcase of a seal left by the sealers.

(Photo. by R. L. Blake.)

Plate VI.

Victoria Penguins (*Catarrhactes pachyrynchus*), a variety made specially handsome by the adornment of a crown and golden eyebrows.

(Photo. by H. Hamilton.)

Plate VII.

A Bull Sea-elephant, just emerged from the ocean water, challenges the Island population.

(Photo. by F. J. Henderson.)

ON *PSEUDOMYS HIGGINSI.*

By

CLIVE LORD, F.L.S.,
Curator of the Tasmanian Museum.

(Read 10th July, 1922.)

Since Higgins and Petterd described (1882, pp. 171-176, and 1883, pp. 181-186, 195-198) several species, the Tasmanian *Rodentia* have not had much attention paid to them. Recently I obtained a series of specimens, and certain of these appear worthy of a further note; particularly so as Higgins and Petterd's types were not preserved and the validity of several of the species which they created has not been maintained. The examination of some specimens of *P. higginsi*, originally described as *Mus leucopus* by Higgins and Petterd (1882, p. 174), led me to forward a typical one to Mr. Oldfield Thomas, of the British Museum, for comparison with those sent to that institution by Mr. Petterd. Upon examination, Mr. Oldfield Thomas states that the specimen forwarded was no doubt *P. higginsi*. In view of the foregoing, the following is of interest. In the list of measurements given with the description of the type, Higgins and Petterd (1882, p. 174) gave the following:—

"Length from tip of nose to root of tail 5¾ inches
"Length of tail .. .. 3¾ inches"

In a later publication (1883, page 186) Higgins and Petterd stated that the measurements of the type specimen were 3¾ inches for both the body and the tail, so it is difficult to know exactly what the type (which was not preserved) did measure; more especially as in the type description they refer to the tail as being long. In the later description reference is made to the fact that further specimens of the species have been secured, and the measurements of same were:—

"From tip of nose to root of tail .. .. .. 5⅛ inches
"Length of tail .. .. 6¾ inches"

The specimens that I have recently examined generally agree with the above as regards size, the length from tip of nose to root of tail averaging 5-5/8 inches and the tail 6-7/8 inches.

Upon the strength of the type description the vernacular description of "Short-tailed mouse" was given to this species,

but it is very apparent that such a designation is not at all appropriate. The most prominent characteristics of the species are the white tip to the nose, the white feet and under parts, and the white hair of the tail. As a vernacular designation the name "White-footed Rat" might be used, but this would lead to confusion with the White-footed pouched mouse (*Sminthopsis leucopus*). Under the circumstances the best vernacular designation appears to be the "Long-tailed Rat."

Mr. Oldfield Thomas has described (1906, p. 776) the differences which exist between the members of the group which are closely allied to *P. higginsi*, and in view of the discrepancies which have existed in the past, the following description of a recent Tasmanian specimen is given:—

♀ Lake Fenton (3,500 feet), Mount Field, Tasmania, March, 1922. Extreme tip of nose white. Whiskers black and white, some over 2 inches long. Fur long, thick, and soft. The general colour of the upper part dark brown, tinged blue. The under fur being slate blue. Darkest colouration on back, merging into pale brown on sides and into greyish white on under surface. Upper portion of tail similar to upper part of body. The whole of the under portion of tail white. Hairs on tail, especially on end, long. Feet white. Upper incisors dark orange, lower light orange. Ears rather large, tail longer than head and body. Claw of fifth hind toe just reaches base of fourth toe. Five sole pads on fore-feet, six on hind-feet.

Dimensions:—	Head and body	160 mm.
	Tail	175 „
	Hind foot	35 „
	Ear conch	27 „
	Muzzle to ear	40 „

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ON A FRESH-WATER SPONGE FROM TASMANIA.

By

PROFESSOR T. THOMSON FLYNN, D.SC.,

University of Tasmania.

(Read 14th August, 1922.)

Very few fresh-water sponges have been recorded from Australia—some nine or ten species in all, not one of which is Tasmanian.

The sponge referred to in the present note is apparently the only Tasmanian form yet obtained.

Its discovery was due primarily to the enthusiasm of F. A. Callaway, Esq., of Wynyard, who takes a keen interest in the natural history of his own district.

About a mile from the town of Wynyard, on the way to Flowerdale, the road is crossed by a small creek which flows into the River Inglis. The creek is here dammed for the purpose of driving the engines of the local flour mill. Just below the dam is a shaded pool, which is sometimes full of water, sometimes nearly dry, the water rippling over the rounded pebbles. This pool is quite a rich collecting ground.

Some years ago, when on a visit to the Wynyard district with Professor D. M. S. Watson, of the University College, London, our attention was directed to the possibilities of this spot by Mr. Callaway, who had collected there on previous occasions, and now informed us of the existence of a fresh-water sponge. A search among the pebbles yielded most interesting results. Not only did we find the pale-yellow incrustation of sponge, but we were lucky enough to chance upon a plentiful supply of the interesting fresh-water hydrozoan, *Cordylophora*, which also, as far as I know, has not been recorded from Tasmania. *Hydra* was also present in abundance.

Mr. Callaway, on a later occasion, forwarded me further specimens of the sponge, and these were sent to Dr. N. Annandale, of the Indian Biological Survey, to whom I am greatly indebted for their identification.

The sponge proves to be identical with *Ephydatia multiformis*, Weltner, discovered by the German South-West Australian Expedition in Herdman's Lake, N.W. from Subiaco, Western Australia. It was described by Dr. W. Weltner as

a new species in "Die Fauna Südwest-Australiens," Bd. III., Lief. 5, and to this publication I would refer those who wish for further information as to its structure and affinities.

It is somewhat remarkable that this sponge should be recorded from collecting grounds so far apart, but it is in the highest degree probable that rigorous search will disclose its presence in intervening localities.

The discovery of this sponge, occurring as it does on the mainland and in Tasmania, adds another link to the chain of relationships which connects the fauna of this island with that of the continent (1). It may not be out of place to draw attention to the occurrence, in the same district of Tasmania, of the fresh-water crab, *Hymenosoma lacustris*, Chilton, originally found in New Zealand, and since recorded from the Australian continent, from Norfolk Island, and from Lord Howe Island (2).

I may perhaps hope that the publication of this short note may stimulate our young zoologists to the gathering of further species of this interesting, but, at present, little-known group of fresh-water invertebrates.

(1) An admirably clear and concise summary of the then existing knowledge of these relationships was given by Professor W. Baldwin Spencer in his Presidential Address to Section D, Biology, of the Australasian Association for the Advancement of Science at its Hobart meeting in 1892.

(2) See Professor Chas. Chilton, Pap. & Proc. Roy. Soc. Tas., 1919.

A LIST OF THE FISHES OF TASMANIA.

BY CLIVE LORD, F.L.S.,
Director of the Tasmanian Museum.

(Read 9th September, 1922.)

The necessity for a revised list of the fishes of Tasmania has long been apparent. Owing to the recent publication of "A Check List of the Fishes and Fish-like Animals of New "South Wales" by Mr. Allan R. McCulloch, of the Australian Museum, and a "Catalogue of the Fishes of South Australia," by Mr. Edgar R. Waite, F.L.S., Director of the South Australian Museum, the present compilation has been considerably simplified, as the fishes of our Island State have much in common with those of South-East Australian seas.

The present list is merely an outline, and is offered as a basis for future work in the hope that a detailed check-list may be prepared in the near future. There are doubtless many species which have not been recorded from our waters, owing to the fact that so little detailed investigation work has been carried out. Since the publication of the late R. M. Johnston's lists in the Papers and Proceedings of the Royal Society of Tasmania of 1882 and 1890 our knowledge of the marine fauna of Tasmania has been considerably advanced. The work carried out by the Federal Trawler *Endeavour* was of great benefit, and it is to be deeply regretted that the vessel and those who were on board during the fatal voyage to Macquarie Island came to such an untimely end.

In regard to the previous lists of Tasmanian fish it may be noted that later investigation has shown that several species described as new by Johnston and other authorities have merged into the synonymy of previously described species, but it is not possible within the limits of the present paper to record the details of such cases.

Apart from necessary collecting work and the examination of a large number of museum specimens, the work of previous investigators has greatly assisted in the compilation of the present list, and in addition the published results of the *Endeavour's* investigations have been availed of. The compiler also desires to express his special thanks to Mr. Allan R. McCulloch, of the Australian

Museum, as it is largely due to his kindly personal assistance that the compilation of the present list has been made possible.

Subphylum CEPHALOCHORDATA.

Family BRANCHIOSTOMIDÆ.

Epigonichthys bassanus, Gunther.—The Lancelet.

Subphylum CRANIATA.

Class *CYCLOSTOMATA.*

Family MORDACIIDÆ.

Mordacia mordax, Rich.—Short-headed Lamprey.

Geotria australis, Gray.—Pouched Lamprey.

Class *ELASMOBRANCHI.*

Order SELACHII.—Sharks.

Family HEXANCHIDÆ.

Notorhynchus pectorosus, Garman. — Seven-gilled Shark.

Heptranchias perlo, Bonn.—One-finned Shark.

Family HETERODONTIDÆ.

Heterodontus philippi, B. & S.—Bull-headed Shark (Port Jackson Shark).

Gyropleurodus galeatus, Gunther.—Crested-headed Shark. (Crested Port Jackson Shark.)

Family CARCHARHINIDÆ.

Prionace glauca, Linn.—Blue Shark.

Galeorhinus australis, Macleay.—School Shark.

Family MUSTELIDÆ.

Mustelus antarcticus, Gunther.—Gummy Shark.

Family SPHYRNIDÆ.

Sphyrna zygæna, Linn.—Hammer-headed Shark.

Family ORECTOLOBIDÆ.

Orectolobus maculatus, Bonn.—Wobbegong.

Parascyllium collare, Rams. and Ogl.—Collared Cat Shark.

Parascyllium variolatum, Dum.—Varied Cat Shark.

Family SCYLLIORHINIDÆ.

Halælurus analis, Ogilby.—Spotted Cat Shark.

Cephaloscyllium isabella, Dumeril.—Swell Shark.

Family ALOPIIDÆ.

Alopias vulpinus, Bonn.—Thresher Shark.

Family CARCHARIIDÆ.

Carcharius arenarius, Ogilby.—Long-toothed Shark.

Family ISURIDÆ.

Isurus glacus, M. & H.—Blue Pointer.

Family SQUALIDÆ.

Squalus megalops, Macleay.—Piked Dog Fish

Squalus fernandinus, Molina.—Spotted Dog Fish.

Oxynotus bruniensis, Ogilby.—Prickly Dog Fish.

Family PRISTIOPHORIDÆ.

Pristiophorus cirratus, Latham.—Saw Shark.

Pristiophorus nudipinnis, Gunther.—Saw Shark.

Family SQUATINIDÆ.

Squatina australis, Regan.—Angel Shark.

Order BATOIDEI.—Rays.

Family RHINOBATIDÆ.

Trygonorrhina fasciata, M. & H.—Fiddler.

Family NARCOBATIDÆ.

Narcine tasmaniensis, Rich.—Tasmanian Numbfish.

Family RAJIDÆ.

Raja nitida, Gunther.—Rough-backed Skate.

Raja lemprieri, Rich.—Thorn-back Skate.

Family DASYATIDÆ.

Dasyatis brevicaudatus, Hutton.—Short-tailed Stingaree.

Urolophus cruciatus, Lacep.—Banded Stingaree.

Urolophus viridis, McCulloch.—Green-backed Stingaree.

Urolophus bucculentus, Macleay.—Sandy-backed Stingaree.

Family MYLIOBATIDÆ.

Myliobatis australis, Macleay.—Eagle or Whiptail Ray.

Order HOLOCEPHALI.—Ghost Sharks, Etc.

Family CHIMÆRIDÆ.

Chimæra ogilbyi, Waite.—Ghost Shark.

Family CALLORHYNCHIDÆ.

Callorhynchus millii, Bory.—The Elephant Fish.

Class *PICES*.

Sub-Class *Teleostii*.—Bony Fishes.

Order ISOSPONDYLI.—Herrings and Trout-like Fish.

Family ENGRAULIDÆ.

Engraulis australis, Shaw.—Australian Anchovy.

Family CLUPEIDÆ

Clupea bassensis, McCull.—Australian Sprat.

Stolephorus robustus, Ogilby.—Blue Sprat.

Sardinia neopilchardus, Steidachner.—Australian Pilchard.

Family GONORHYNCHIDÆ.

Gonorhynchus greyi, Rich.—Beaked Salmon.

Family GALAXIIDÆ.

Galaxias attenuatus, Jenys.—Jollytail.

Galaxias weedoni, Johnston.—The Mersey Jollytail.

Galaxias truttaceus, Cuv. and Val.—Spotted Mountain Trout.

Galaxias auratus, Johnston.—Lake Trout.

Family SALMONIDÆ.

Introduced species of *Salmonidæ*.

Salmo salar, Linn.—Salmon.

Salmo fario, Linn.—Brown Trout.

Salmo irideus, Gibbons.—Rainbow Trout.

Salmo levenensis.—Loch Leven Trout.

Salmo trutta.—Salmon Trout.

Salmo frontalis.—American Brook Trout.

Salmo sebago.—Sebago Salmon.

Onchorhynchus nerka.—Sock-eyed Salmon.

Onchorhynchus quinnat.—Quinnat Salmon.

Family ARGENTINIDÆ.

Argentina elongata, Hutton.—Siel Smelt.

Family APLOCHITONIDÆ.

Prototroctes maræna, Gunther.—Australian Grayling ("Cucumber Herring").

Lovettia sealii, Johnston.

Family RETROPINNIDÆ.

Retropinna tasmanica, McCulloch.—Tasmanian Smelt ("Whitebait").

Order INIOMI.—Cucumber Fish, Etc.

Family SUDIDÆ.

Chlorophthalmus nigripinnis, Gunther.—Cucumber Fish.

Family ALEPISAURIDÆ.

Alepisaurus ferox, Lowe.—Lancet Fish.

Order OSTARIOPHYSI (Introduced).

Family CYPRINIDÆ.

Carassius carassius, Linn.—European Carp. (Intro.)

Carassius auratus, Linn.—Gold Fish. (Intro.)

Tinca tinca, Linn.—English Tench. (Intro.)

Order SYMBRANCHII.—Pigmy Eels.

Family CHEILOBRANCHIDÆ.

Cheilobranchus rufus, Macleay.—Red-banded Shore Eel.

Cheilobranchus dorsalis, Rich.—Striped Brown Eel.

Order APODES.—Eels.

Family ANGUILLIDÆ.

Anguilla australis, Rich.—Short-finned Eel.
Anguilla reinhardtii, Stdr.—Long-finned Eel.

Family LEPTOCEPHALIDÆ.

Leptocephalus conger, Linn.—Common Conger Eel.
Leptocephalus wilsoni, Castel.—Conger Eel.
Congermuræna habenata, Rich.—Little Conger Eel (Silver Eel of Tasmania).

Family ECHELIDÆ.

Muræenichthys tasmaniensis, McCull.—Tasmanian Worm Eel.
Muræenichthys breviceps, Gunther.—Short-headed Eel.

Family OPHICHTHYIDÆ.

Ophisurus serpens, Linn.—Snake Eel.

Order SOLENICHTHYES.—Bellows Fish, Pipe Fish, Etc.

Family MACRORHAMPHOSIDÆ.

Macrorhamphosus elevatus, Waite.—Bellows Fish.
Centriscops humerosus, Rich.—Bellows Fish.
Notopogon lilliei, Regan.—Bellows Fish.

Family LAMPRIDIDÆ.

Lampris luna.—Opah.

Family SYNGNATHIDÆ

Corythoichthys phillipi, Lucas.—Pipe Fish.
Urocampus carinirostris, Castelnau.—Pipe Fish.
Stigmatopora argus, Rich.—Pipe Fish.
Stigmatopora nigra, Kaup.—Pipe Fish.
Leptonotus semistriatus, Kaup.—Pipe Fish.
Solegnathus spinosissimus, Gunther.—Pipe Fish.
Solegnathus fasciatus, Gunther.—Sea Horse.
Histiogamphelus briggsi, McCulloch.
Phyllopteryx foliatus, Shaw.—Leafy Sea Horse.
Hippocampus abdominalis, Lesson.—Sea Horse.
Hippocampus breviceps, Peters.—Sea Horse.

Order HYPOSTOMIDES.—Dragon Fish.

Family PEGASIDÆ.

Acanthopegasus lancifer, Kaup.—Dragon Fish.

Order SYNENTOGNATHI.—Garfish, Etc.

Family HEMIRHAMPHIDÆ.

Hemirhamphus intermedius, Cantor.—Sea Garfish.

Order ANACANTHINI.—Cods and Whiptails.

Family GADIDÆ.

Lotella callarias, Gunther.—Kelp Rock Cod.
Physiculus barbatus, Gunther.—Common Rock Cod.
Physiculus bachus, Forster.—Red Rock Cod.

Family CORYPHÆNOIDIDÆ.

Cœlorhynchus australis, Rich.—Grenadier or Whiptail.
Macruronus novæ-zelandiæ, Hector.—Whiptail.
Optonurus denticulatus, Rich.—Deep Sea Whiptail.

Order BERYCOMORPHI.—Nannygai, Etc.

Family TRACHICHTHYIDÆ

Trachichthodes affinis, Gunther.—Nannygai.
Trachichthys australis, Shaw.
Paratrachichthys trailli, Hutton.—Sandpaper Fish.

Family ZEIDÆ.

Zeus faber, Linn.—John Dory.
Zenopsis nebulosus, Schleg.—Mirror Dory.
Cyttus novæ-zelandiæ, Arthur.—Silver Dory.
Cyttus australis, Rich.—Silver Dory.

Order ALLOTRIOGNATHI.—Ribbon Fish.

Family REGALECIDÆ.

Regalecus glesne, Ascanius.—The Oar Fish.

Family TRACHYPTENDÆ.

Trachypterus altivelis, Kner.—Ribbon Fish.

Family LOPHOTIDÆ.

Lophotes guntheri, Johnston.

Order HETEROSOMATA.—Flounders, Etc.

Family BOTHIDÆ.

Pseudorhombus multimaculatus, Gunther.—Small-toothed Flounder.
Pseudorhombus tenuirastrum, Waite.—Deep-water Flounder.
Lophonectes gallus, Gunther.—Crested Flounder.

Family PLEURONECTIDÆ.

Ammotretis rostratus, Gunther.—Long-snouted Flounder ("Sole" of Tasmania).

Ammotretis tudori, McCulloch.—Flounder.

Ammotretis macrolepis, McCulloch.—Flounder.

Rhombosolea flesoides, Gunther.—Southern Flounder.

Rhombosolea tapirina, Gunther.—Flounder.

Family CYNOGLOSSIDÆ.

Paraplagusia unicolor.*—Tongue or Lemon Sole.

Order PERCOMORPHI.

Sub-Order MUGILOIDEA.

Family MUGILIDÆ.

Mugil cephalus, Linn.—Sea Mullet.

Myxus elongatus, Gunther.—Sand Mullet (Tallegallane of New South Wales).

Agonostomus fosteri, Cuv. & Val.—Yellow-eyed Mullet.

Family ATHERINIDÆ.

Atherina microstoma, Gunther.—Silver Fish.

Atherina dannevigi, McCulloch.—Silver Fish.

Atherina presbyteroides, Rich.—Silver Fish.

Atherina hepsetoides, Rich.—Silver Fish.

Atherina hepsetus, Linn.—Silver Fish.

Atherina tamarensis, Johnston.—Silver Fish.

Atherina jacksoniana, Quoy & Gaim.—Silver Fish.

Family SPHYRÆNIDÆ.

Sphyræna novæ-hollandiæ, Gunther.—Short-finned Sea Pike.

Sub-Order STROMATEOIDEA.

Family STROMATEIDÆ.

Seriolella brama, Gunther.—Snotgall Trevally.

Seriolella punctata, Forster.—Spotted Trevally.

Seriolella doubla, Gunther.—Mackerel Trevally.

Hyperoglyphe johnstoni, Morton.

Sub-Order PERCOIDEA.

Family PERCIDÆ.

Perca fluviatilis, Rondel.—English River Perch (Intro.).

*Recorded by Mr. H. H. Scott, from North-East Coast of Tasmania.

Family SERRANIDÆ.

Polyprion oxygeneios, Bloch and Schneider.—Hapuku (of New Zealand).

Callanthias allporti, Gunther.—Allport's Perch.

Cæsioperca lepidoptera, Forster.—Red Perch.

Cæsioperca rasor, Rich.—Red Perch or Tasmanian Barber.

Percalates colonorum, Gunther. — Brackish-water Perch.

Nannoperea tasmaniæ, Johnston.—Fresh-water Perch.

Family PLESIOPIDÆ.

Trachinops caudomaculatus, McCoy.—Blotched-tailed Trachinops.

Family APOGONIDÆ.

Apogon fasciatus, Shaw.—Soldier Fish (of New South Wales).

Apogon novæ-hollandiæ, Val.

Apogon lemprieri, Johnston.

Dinolestes lewini, Giff.—Long-finned Sea Pike.

Family OPLEGNATHIDÆ.

Oplegnathus conwayi, Rich.

Family SILLAGINIDÆ.

Sillago punctatus, Cuv. and Val.—Spotted Whiting.

Sillago maculata, Quoy and Gaim.—Trumpeter Whiting.

Sillago bassensis, Cuv. and Val.—School Whiting.

Family POMATOMIDÆ.

Pomatomus saltatrix, Linn.—Tailor or Skipjack.

Family CARANGIDÆ.

Trachurus declivis, Jenys.—Yellow Tail.

Trachurus novæ-zelandiæ, Rich.—Horse Mackerel of Tasmania and New Zealand (Cowanyoung of New South Wales).

Caranx georgianus, Cuv. and Val.—Silver Trevally.

Naucrates ductor, Linn.—Pilot Fish.

Seriola grandis, Castel.—Tasmanian Yellow Tail (Kingfish of New South Wales).

Family ARRIPIDIDÆ.

Arripis trutta, B. and S.—Australian Salmon (Native Salmon).

Family ERYTHRICHTHYIDÆ.

Emmelichthys nitidus, Rich.—Pearl Fish.

Family SCIÆNIDÆ.

Sciæna antarctica, Castelnau.—Jew Fish (of New South Wales), Dew Fish (of Queensland), King Fish (of Victoria and West Australia), Butter Fish (of South Australia).

Family MULLIDÆ.

Upeneichthys porosus, Cuv. and Val.—Blue-striped Red Mullet.

Family SPARIDÆ.

Pagrosomus auratus, B. and S.—Snapper.

Sparus australis, Gunther.—Silver Bream of Tasmania (Black Bream of New South Wales).

Family GIRELLIDÆ.

Girella tricuspidata, Q. and G.—Black Bream, Tasmania.

Family PEMPHERIDÆ.

Liopempheris multiradiata, Klun.—Big-scaled Bull Eye.

Parapriacanthus elongatus, McCulloch.—Elongated Bull Eye.

Family SCORPIDIDÆ.

Scorpis georgianus, Cuv. and Val.

Family ENOPLOSIDÆ.

Enoplosus armatus, Shaw.—"Old Wife" or Zebra Fish.

Family HISTIOPTERIDÆ.

Paristiopterus labiosus, Gunther.—Giant Boar Fish.

Zanclistius elevatus, Rams and Og.—Short Boar Fish.

Pentaceropsis recurvirostris, Rich.—Long-snouted Boar Fish.

Family APLODACTYLIDÆ.

Dactylosargus arctidens, Rich.—Marbled Kelp Fish.

Family CHIRONEMIDÆ.

Chironemus marmoratus, Gunther.—Large Kelp Fish.

Family CHEILODACTYLIDÆ.

Dactylopagrus macropterus, B. and S.—Black and Silver Perch. (Jackass Fish of New South Wales and South Australia.)

Dactylopagrus morwong, R. and O.—Morwong (Great Perch of Tasmania).

Dactylophora nigricans, Rich.—Dusky Morwong (Butter Perch).

Goniistius vizonarius, Kent.—Magpie Perch.

Cheilodactylus spectabilis, Hutton.—Carp of Tasmania.

Family LATRIDIDÆ.

Latris lineata, B. and S. — Real Trumpeter ("Stripey").

Latridopsis fosteri, Castelnau.—Bastard Trumpeter.

Latridopsis ciliaris, Forster.—Bastard Trumpeter.

Mendosoma allporti, Johnston.—Real Bastard Trumpeter.

Family POMACENTRIDÆ.

Glyphidodon victoriæ, Gunther.—Rock Perch, "Scaly Fin."

Family LABIDÆ.

Pseudolabrus tetricus, Rich.—Lilac-banded Parrot Fish.

Pseudolabrus psittaculus, Rich.—Parrot Fish.

Pseudolabrus celidotus, Richardson.—Parrot Fish.

Pseudolabrus fucicola, Rich.—Purple Parrot Fish.

Pictilabrus laticlavius, Rich.—Green-banded Parrot Fish.

Achoerodus gouldii, Rich.—Blue Groper.

Verreo oxycephalus, Bleeker.—Pig Fish.

Family NEOODACIDÆ.

Neoodax semifasciatus, Cuv. and Val.—Rock Whiting (Stranger).

Neoodax balteatus, Cuv. and Val.—("Ground Mullet") Little Rock Whiting.

Neoodax beddomei, Johnston.

Olisthops cyanomelas, Rich.—Herring Cale.

Family GADOPSIDÆ.

Gadopsis marmoratus, Rich.—River Blackfish.

Family PINGUIPEDIDÆ.

Parapercis allporti, Gunther.

Family URANOSCOPIDÆ.

Kathetostoma læve, Bl.—Catfish (Stone-lifter).

Family BOVICHTIIDÆ.

Pseudaphritis urvilli, Castel.—Fresh-water Flathead or Sandy.

Bovictus variegatus, Cuv. and Val.

Family CALLIONYMIDÆ.

Callionymus papilio, Gunther.

Family SCOMBROIDÆ.

Scomber australasicus, Cuv. and Val.—Mackerel.
Gasterochisma melampus, Rich.—Butterfly Fish.
Auxis thazard, Lacep.—Frigate Mackerel.
Thunnus maccoyi, Castel.—Southern Tunny.
Sarda chiliensis, Cuv. and Val.—Horse Mackerel (of New South Wales).

Family ISTIOPHORIDÆ.

Tetrapturus indicus, Cuv. and Val.—Sword Fish.

Family TRICHIURIDÆ.

Lepidopus caudatus, Euph.—Frost Fish.

Family GEMPYLLIDÆ.

Jordanidia solandri, Synder.—King Barracouta.
Thyrsites atun, Euph.—Barracouta.

Family GOBIIDÆ.

Gobius tamarensis, Johnston.—Tamar Goby.
Gobius lateralis, Macleay.
Gobius hinsbyi, Johnston.

Family BLENNIIDÆ.

Blennius tasmanianus, Rich.—Blenny or Bully.
Clinus perspicillatus, Cuv. and Val.
Clinus johnstoni, Saville Kent.
Cristiceps australis, Cuv. and Val.
Cristiceps fosteri, Castel.
Gillias clarkei, Morton.

Sub-Order OPHIDIOIDEA.

Family OPHIDIIDÆ.

Genypterus blacodes, B. and S.—Ling.

Order DISCOCEPHALI.—Sucker Fish.

Family ECHENEIDIDÆ.

Echeneis naucrates, Linn.—Slender Sucker Fish.
Remora remora, Linn.—Short Sucker Fish.

Order SCLEROPAREI.

Family SCORPÆNIDÆ.

Scorpæna cruenta, Rich.—Gurnet. (Red Rock Cod of New South Wales and South Australia.)
Scorpæna cardinalis, Rich.—Gurnet.
Helicolenus percoides, Rich.—Rock Gurnet.
Neobastes thetidis, Waite.—Rough Gurnet Perch.
Neosebastes panda, Rich.—Gurnet.
Glyptauchen panduratus, Rich.—Goblin Fish.

Centropogon australis, Gunther.—Fortesque of New South Wales.

Pentaroge marmorata, Cuv. and Val.—Soldier of Tasmania.

Family PATÆCIDÆ.

Gnathanacanthus goetzi, Bleeker.—Velvet Fish.

Patæcus maculatus, Gunther.

Family TRIGLIDÆ.

Lepidotrigla vanessa, Rich.—Butterfly Gurnard.

Chelidonichthys kumu, Lesson and Garnot.—Kumu Gurnard.

Pterygotrigla polyommata, Rich.—Sharp-beaked Gurnard.

Family HOPLICHTHYIDÆ.

Hoplichthys haswelli, McCulloch.—Spiny Flathead.

Family PLATYCEPHALIDÆ.

Platycephalus fuscus, Cuv. and Val.—Dusky Flathead.

Platycephalus bassensis, Cuv. and Val.—Common Tasmanian Flathead.

Platycephalus lævigatus, C. and V.—Smooth Flathead.

Order XENOPTERI.

Family GOBIESOCIDÆ.

Diplocrepis cardinalis, Ramsay.

Aspasmogaster tasmaniensis, Gunther.

Order PEDICULATI.

Family BATRACHOIDIDÆ.

Pseudobatrachus dubius, Shaw.—Frog Fish.

Family ANTENNARIIDÆ.

Histrio histrio, Linn.—Marbled Angler.

Trichophryne mitchelli, Morton.—Prickly Angler.

Family BRACHIONICHTHYIDÆ.

Brachionichthys hirsutus, Lacep.—Hand Fish.

Brachionichthys politus, Rich.—Red Hand Fish.

Family OGCOCEPHALIDÆ.

Halieutæa brevicauda, Ogilby.

Order PLETOGNATHI.

Family MONACANTHIDÆ.

Cantherines hippocrepis, Q. and Gaim.—Variable Leather Jacket.

Cantherines guntheri, Macleay.—Tooth-brush Leather Jacket.

Cantherines spilomelanurus, Q. and G.—Golden-eyed Leather Jacket.

Cantherines maculosus, Rich.—Small Brown Leather Jacket.

Cantherines mosaicus, Rams. and Ogl.—Mosaic Leather Jacket.

Cantherines melas, Gunther.—Black Leather Jacket.

Cantherines gunni, Gunther.—Dark Brown Leather Jacket.

Cantherines convexirostris, Gunth.—Grey Leather Jacket.

Cantherines rudis, Rich.—White-banded Leather Jacket.

Cantherines peronii, Hollard.—Pale Brown Leather Jacket.

Brachaluteres trossulus, Richardson.—Pigmy Leather Jacket.

Family OSTRACIIDÆ.

Aracana aurita, Shaw.—Trunk Fish.

Aracana ornata, Gray.—Yellow-striped Trunk Fish.

Family TETRAODONTIDÆ.

Spheroides hamiltoni, Rich.—Toad Fish.

Spheroides richei, Frem.—Globe Fish.

Family DIODONTIDÆ.

Allomycterus jaculiferus, Cuvier.—Porcupine Fish.

Atopomycterus nychthemerus, Cuv.—Slender-spined Porcupine Fish.

Family MOLIDÆ.

Mola mola, Linn.—Sun Fish.

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ON THE TASMANIAN *MURIDÆ*

By

Clive Lord, F.L.S.

(Director of the Tasmanian Museum),

and

H. H. Scott

(Curator of the Launceston Museum).

(Read 13th November, 1922.)

In carrying out investigations concerning the Tasmanian *Muridæ* certain information has been gathered which appears worthy of placing on record.

Since Higgins and Petterd dealt with certain Tasmanian forms in 1882 and 1883 very little attention has been paid to the Tasmanian *Rodentia*. Unfortunately, Higgins and Petterd relied on mere external variations on which to found their species, and many will doubtless merge into synonymy. Further, their type specimens were not preserved.

In the present instance, therefore, we desire to give a list of the Tasmanian *Muridæ* as far as our investigations have shown them, and at the same time to draw attention to the very wide distribution of the introduced *Rattus rattus* in Tasmania. This common form is not only found in the cities and settled areas, but also finds its way far into the bush. Here it takes on new habits, which have the effect of considerably altering the species, as far as external variations go, from the typical form, and care must be taken in regard to identification.

Sub-Order *SIMPLICIDENTATA.*

Genus *Hydromys.*

This genus is easily recognised on account of the molars being reduced to two pairs, which is the smallest number among the rodents. The skull lacks the projecting zygomatic plate. The toes are partially webbed.

Hydromys chrysogaster, Geoffroy.

Hydromys chrysogaster, Geoffroy, Ann. Mus. Hist. Nat., p. 90 (1805).

Orange-bellied Water Rat.

Owing to the outstanding characteristics of the genus, its aquatic habits, and distinctive colouration, this species has not become confused with other forms, and the synonymy is simple. It is a fairly common species in localities suitable to its habits.

Genus *Rattus*.

Rattus lutreola, Gray.

Mus lutreola, Gray, Grey's travels in N.W. and W. Aust. App., p. 409.

Dusky-footed Rat.

The Dusky-footed rat of Tasmania and South-Eastern Australia is usually referred to as *Rattus fuscipes* (= *Mus fuscipes*), but Mr. Oldfield Thomas has pointed out to us that *R. fuscipes* should be retained for the West Australian form, and that the Tasmanian rat is *Rattus lutreola*. It is generally found in the vicinity of water, and can swim well.

Rattus velutinus, Thomas.

Mus velutinus, Thomas, A.M.N.H., IX., p. 415 (1882).

Mus castaneus, Higgins & Petterd, P. & P. Roy. Soc. Tas., p. 183 (1883).

This rather distinctive species shows a general colouration of from grey to chestnut, the ears, feet, and tail sometimes being brownish in colour. We are of the opinion that the type of *Mus castaneus* of Higgins and Petterd was really a male of *R. velutinus*.

Pseudomys higginsi.

Mus leucopus, Higgins & Petterd, P. & P. Roy Soc. Tas., p. 124, 1882, and 1883, p. 186.

Long-tailed Rat.

This species is one of the commonest rodents of the Tasmanian bush. It is often found high up on the mountains as well as on the plains. Note revised description of this species by Lord (P. & P. Roy. Soc. Tas., 1922, pp. 55-57)

Genus *Mastacomys*.

Mastacomys fuscus, Thomas.

Mastacomys fuscus, Thomas, A.M.N.H., p. 414, No. 54, 5th Ser. (1882).

Broad-toothed Rat.

This species is remarkable for the exceptional broadening of the molars. As far as is known at present, this species is confined to Tasmania, but fossil remains of a similar form have been found in the Wellington Valley caves of New South Wales.

With regard to other species further research is needed, but the foregoing are the only ones that we propose to recognise as valid indigenous Tasmanian forms, until further research shows the validity of other species.

In 1882 and 1883 Higgins and Petterd described no less than eight new species, as follows:—

1. *Mus grisco-cœruleus* (Blue Rat).
2. *Mus leucopus* (Short-tailed Rat).
3. *Mus variabilis* (Swan's Rat).
4. *Mus simsoni* (Simson's Rat).
5. *Mus pachyurus* (Thick-tailed Rat).
6. *Mus castaneus* (Chestnut coloured Rat).
7. *Mus tamarensis* (Tasmanian Water Rat).
8. *Mus tetragonurus* (Quadrangular-tailed Rat).

Of the above we are of the opinion that at least *M. grisco-cœruleus*, *M. variabilis*, and probably *M. tamarensis* are synonymous with *R. rattus.* The British Museum specimens of *M. simsoni* show this supposed species to be merely the introduced *M. musculus*.

SOME ADDITIONS TO OUR RECORDED FLOWERING PLANTS.

By L. Rodway, C.M.G.
Government Botanist of Tasmania.

Plate VIII.

(Read 13th November, 1922.)

Eucalyptus dalrympleana, J. H. Maiden. This white gum has hitherto been included by us as one of the forms grouped under the name of *Euc. viminalis.* It differs from the type in general robustness, bark smooth from the base, and the leaves of the immature shoots being relatively broader and boldly cordate at the base. The tree is widely distributed in Tasmania.

Eucalyptus irbyi, R. T. Baker. A small tree with a smooth, pale, or ashy-coloured bark. Abnormal leaves broad-ovate to ovate, sometimes mucronate, petiolate, base rounded, truncate, or slightly cordate, fairly thick and coriaceous. Normal leaves coarse, lanceolate to broad lanceolate, or even ovate, acuminate, up to 8 inches long, mostly straight, on unusually long petioles; venation often indistinct, intra-vein looped, well removed from the edge, lateral veins spreading, distant, inclined at an angle of 30-40 deg. to the mid-rib. Peduncles angular, axillary, 1-2 lines long, bearing umbels of mostly three flowers. Buds shortly pedicellate; calyx-tube turbinate, 2 lines in length; operculum blunt, conical, often slightly broader than and more than half as long as the tube. Fruit hemispherical to sub-cylindrical glaucous or shining, rim flat to convex, often somewhat depressed, cracked transversely; valves more or less exserted; 3 lines long and 3 lines diameter.

The above is Mr. Baker's description as given in his noble work on essential oils of the eucalypts. It is admittedly close to *Euc. gunnii. Euc. gunnii* is a most variable group of forms, and it is more a matter of individual opinion than certainty what forms should be removed from the type and elevated to specific rank. When fully understood probably other specific names will be added to the list.

The specimens of the tree were gathered by Mr. Irby, the Conservator of Forests, at Alma Tier.

Caladenia atkinsoni, n.s. About six inches high with a single filiform leaf arising from the scape and flower struc-

ture of the Section Eucaladenia except in the peculiar labellum. Stem, leaf, and outer surfaces of perianth lobes delicately hirsute. Flowers usually one or two, externally very pale green, each lobe marked in the centre by a narrow red-brown line. Dorsal sepal erect with a recurved acute apex, linear 1cm. Ventral sepals similar; lateral petals rather broader. Labellum irregularly rhomboid to oblong-acuminate flat, white, nearly as long as the lobes, apex acute not at all recurved, lateral lobes obtuse forming simple expansions, bearing neither calli nor fimbriations.

Gathered by Rev. H. B. Atkinson, M.A., on Natone Hill, Lindisfarne, October, 1922. It has the erect dorsal sepal of *C. carnea* and some of the purple colour of *C. testacea*, but differs from both in the peculiar labellum. The only other member of the genus with the absence of calli on the labellum is *C. fimbriata* of West Australia and that belongs to the section *Leptoceras*.

In the same locality Mr. Atkinson met with *Pterostylis curta*, a plant not usually met with in Southern Tasmania. It may be recognised from *P. nutans* by its erect flower and blunter, shorter perianth lobes.

Microtis atrata, Lindl. Usually about 3 inches high. Green when fresh, darker when dry. The flowers are very small crowded in a short spike. Flowers about one millimetre long, labellum entire broad, almost quadrate, not callous.

Near George Town.

Pterostylis toveana, A. J. Ewart. This is an intermediate form between *P. præcox* and *P. concinna*. In Tasmania we generally find it where these two are associated and consequently suspect hybridisation.

Pterostylis pedoglossa, Fitz. With much the appearance and tapering lobes of *P. obtusa* it has a shorter, obtuse labellum and a rosette of leaves at the base of the stem.

It occurs at Eaglehawk Neck.

Thelymitra luteocilium, Fitz. A robust plant with many pink flowers and copious ciliate development of the column lateral lobes. In the Flora I have treated it as a possible hybrid between *T. carnea* and *T. ixioides*.

For the last two determinations I am indebted to Dr. Rogers and Mr. Pescott.

The sedge referred to in the Flora as *Carex barbata, Boott*, has since been described as a new species under name *Carex tasmanica*.

Caladenia atkinsoni, Rod.

ROYAL SOCIETY OF TASMANIA

ABSTRACT OF PROCEEDINGS

1922

20th MARCH, 1922.

Annual Meeting.

The Annual Meeting was held at the Society's Rooms, the Tasmanian Museum, on 20th March, 1922, His Excellency the Administrator (Sir Herbert Nicholls) presiding. The Annual Report and Statement of Accounts were read and adopted. The following were elected as members of the Council:—Messrs. W. H. Clemes, W. H. Cummins, Dr. W. L. Crowther, Major L. F. Giblin, The Right Reverend Dr. R. S. Hay, Messrs. J. A. Johnson, J. Moore-Robinson, L. Rodway, and Dr. Gregory Sprott. Mr. R. A. Black was appointed Hon. Auditor.

The following members were elected:—Mrs. Hungerford, Miss Hungerford, Miss Overell, Miss Perrin, Rev. F. B. Sharland, Messrs. J. D. A. Collier, W. R. Johnson, A. V. Giblin, J. R. Leslie, P. S. Seager, A. A. Winch.

Paper.

"The Tubenoid Glands of *Nototherium mitchelli*," by H. H. Scott and C. E. Lord.

Illustrated Lecture.

Mr. Clive Lord delivered an illustrated lecture on "Captain Bligh's Two Voyages to Tasmania, 1788 and 1792."

10th APRIL, 1922.

The Monthly Meeting was held at the Society's Rooms on the 10th April, Mr. J. A. Johnson presiding.

The following members were elected:—Sir Henry Jones, Messrs. F. L. Biss, Andrew Kemp, E. H. Thompson, J. R. Johnston, R. H. Warner, H. T. Parker, R. Davidson.

Papers.

The following Papers were read:—"On *Phascum tasmanicum*," by H. M. Dixon and L. Rodway; "A Biometric Survey of the Conidia of *Macrosporium* and *Alternaria*," by F. W. Wakefield.

Illustrated Lecture.

Mr. Loftus Hills, M.Sc., M.B.E., Director of the Geological Survey, delivered an illustrated lecture on "Oil," dealing with the question of liquid oil in Tasmania.

8th MAY, 1922.

The Monthly Meeting was held at the Society's Rooms on the 8th May, Mr. J. A. Johnson presiding.

Reference was made to the death of Mr. R. Sticht, a life-member of the Society, and a motion of condolence was passed, all members standing.

The following resolution, moved by Mr. Clive Lord, and seconded by Mr. Walter E. Taylor, was passed:—"That the Royal Society of Tasmania is in sympathy with the Municipal Council of Flinders Island in their endeavour to have the Old Church and Cemetery site at Flinders Island (Settlement Point) proclaimed a reserve."

The following members were elected:—Miss Gatenby, Messrs. F. N. Murdoch, G. Gurth, and Col. Thomas.

Paper.

"An additional Note on the Topography of Lake Fenton and District," by A. N. Lewis, M.C., LL.B.

Illustrated Lecture.

J. Moore-Robinson, F.R.G.S., delivered an illustrated lecture on "The Panama Canal."

12th JUNE, 1922.

The Monthly Meeting was held at the Society's Rooms on the 12th June, 1922, His Excellency the Administrator, Sir Herbert Nicholls, presiding.

The following members were elected:—Messrs. J. Kennedy, H. Sargison, and D. W. Watson.

Mr. Clive Lord exhibited specimens of the Pink-eared Duck (*Malacorhynchus membraceus*), and the Red Crowned Fruit Pigeon (*Ptilinopus regina*). The former was a rather rare visitor to Southern Tasmania, and the occurrence of the latter species had not previously been recorded.

Paper.

"Macquarie Island and Its Future," by Sir Douglas Mawson, Kt., D.Sc.

Illustrated Lecture.

Mr. E. T. Emmett, Director of the Tasmanian Government Tourist Bureau, delivered an illustrated lecture on "The National Reserve at Lake St. Clair-Cradle Mountain."

10th JULY, 1922.

The Monthly Meeting was held at the Society's Rooms on the 10th July, 1922, Mr. L. Rodway, C.M.G., Vice-President, presiding.

A vote of condolence was passed on account of the death of one of the Society's members, Mr. Frank M. Littler, F.E.S., of Launceston.

The following members were elected:—Miss N. Davern, Miss A. L. Wayn, Messrs. A. W. Adams, H. Bamford, and Rev. F. E. Oxer.

Paper.

"On *Pseudomys higginsi*," by Clive Lord, F.L.S.

Lecture.

A discussion on Governor Macquarie and his visits to Tasmania in 1811 and 1821 was held, Mr. Moore-Robinson opening the discussion, and being followed by Messrs. Courtney Pratt, A. W. Adams, W. F. D. Butler, Clive Lord, J. Reynolds, and Dr. W. L. Crowther.

14th AUGUST, 1922.

The Monthly Meeting was held at the Society's Rooms on the 14th August, Mr. L. Rodway, C.M.G., Vice-President, presiding.

Mr. G. Huxley was elected a member.

Paper.

"On a Freshwater Sponge from Tasmania," by Professor T. Thomson Flynn, D.Sc.

Mr. Clive Lord exhibited a specimen of a Giant Petrel (*Macronectes giganteus*), which had recently been obtained from the Huon River.

Reference was also made to the discovery of aboriginal remains at South Arm by Mr. E. A. Calvert, who presented them to the Tasmanian Museum.

Illustrated Lecture.

Mr. L. Rodway, C.M.G., delivered an illustrated Lecture on "Tasmanian Wild Flowers." A number of slides were shown, these having been prepared by Mr. J. C. Breaden.

11th SEPTEMBER, 1922.

The Monthly Meeting was held at the Society's Rooms on 11th September, 1922, Mr. L. Rodway, C.M.G., presiding.

The following members were elected:—Messrs. H. O. Burrows and F. W. Hood.

Paper.

"A List of the Fishes of Tasmania," by Clive Lord, F.L.S.

Professor Flynn exhibited a cast of the fossil whale from Wynyard.

Illustrated Lecture.

"Astronomy and the Forthcoming Eclipse," by Dr. Bernard Thomas.

9th OCTOBER, 1922.

The Monthly Meeting was held at the Society's Rooms on 9th October, Mr. L. Rodway, C.M.G., presiding.

The following members were elected:—Messrs. H. M. Lowe and A. A. Reid.

Lectures.

"Notes on William Buckley," by J. Moore-Robinson, F.R.G.S.

"Some Aspects of the Einstein Theory," by Frank Ellis, M.A.

13th November, 1922.

The Monthly Meeting was held at the Society's Rooms on 13th November, 1922, Mr. L. Rodway, C.M.G., Vice-President, presiding.

The following members were elected:—Dr. R. Pulleine, North Terrace, Adelaide, Mr. E. N. Waterworth.

The following resolution proposed by Mr. Lord, and seconded by Mr. Moore-Robinson, was carried:—"That the action of the Historical Section in fixing upon the site where Tasman planted the Dutch flag, as the site of the Memorial, be approved."

Papers.

The following papers were read:—"Additions to our previously recorded Flowering Plants," by L. Rodway, C.M.G.

"On the Tasmanian *Muridæ*," by Clive Lord, F.L.S., and H. H. Scott.

ANNUAL REPORT
1922
The Royal Society of Tasmania

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President:

HIS EXCELLENCY THE ADMINISTRATOR
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A. H. CLARKE, M.R.C.S., L.R.C.P.

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(Elected March, 1922).

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Spencer, Sir W. Baldwin, K.C.M.G., M.A., D.Sc., Litt.D., F.R.S. Melbourne.

Ordinary, Life, and Corresponding Members:

"C," Corresponding Member.

"L," Member who has compounded subscriptions for life.

* Member who has contributed a Paper read before the Society.

† Member who has been elected a member of the Council.

Year of Election.		
1922		Adams, A. W. National Mutual Buildings, Macquarie Street, Hobart.
1921		Anderson, G. M., M.D., C.M. Stowelville, Albert Road, Moonah.
1920		Arnold, T. P. 37 Cromwell Street, Battery Point.
1918	L	Avery, J. 52 Southerland Road, Annandale, Melbourne, Victoria.
1921		Allen, D. V., B.Sc. Principal Launceston Technical College.
1908	L	Baker, Henry D. C/o American Consulate, Hobart.
1921		Baker, H. S., LL.M., M.A. York Street, Sandy Bay.
1922		Bamford, H. Commercial Bank of Australia Chambers, Elizabeth Street, Hobart.
1887		Barclay, David. 143 Hampden Road, Hobart.
1921		Barr, J. Stoddart, M.D., Glas. Lower Sandy Bay.
1890		*Beattie, J. W. 1 Mt. Stuart Road, Hobart.
1918		Bellamy, Herbert, City Engineer. Town Hall, Hobart.
1901	C	Benham, W. B., M.A., D.Sc., F.R.S., F.Z.S. Professor of Biology, University of Otago, Dunedin, N.Z.
1903		Bennett, W. H. Ashby, Ross.
1918		Bennison, E. A. Napoleon Street, Battery Point.

Year of Election.

1921 Bertouch, V. Von. Wellington Square Practising School, Launceston.

1920 Bernacchi, A. G. D. Maria Island.

1921 Bethune, Rev. J. W., B.A. Church Grammar School, Launceston.

1921 Birchall, J. A. 118 Brisbane Street, Launceston.

1922 Biss, F. L. U.S.S. Co., Hobart.

1912 *Black, R. A. Chief Clerk, Department of Agriculture.

1909 *Blackman, A. E. Franklin.

1920 Blaikie, T. W. Practising School, Elizabeth Street, Hobart.

1918 Bowling, J. "Barrington," Tower Road, New Town.

1892 C Bragg, W. H., M.A., F.R.S. Professor of Physics in the University College, London.

1917 Brettingham-Moore, E., M.B., Ch.M. Macquarie Street.

1911 Brooks, G. V. Director of Education, Education Department, Hobart.

1921 Brown, Mrs. Justin. 10 Welman Street, Launceston.

1922 Brownell, C. C. 29 Napoleon Street, Battery Point.

1907 Brownell, F. L. "Leura," Main Road, Moonah.

1921 Bruce, L. S. Tourist Bureau, Launceston.

1922 Brunn, A., M.Sc., M.I.C.E. Manager, Maria Island Portland Cement Company.

1918 Bryer, J. R. Taroona.

1918 Burbury, Alfred. "Glen Morey," Antill Ponds.

1918 Burbury, Frederick. "Holly Park," Parattah.

1919 Burbury, Charles. "Inglewood," Andover.

1919 Burbury, Gerald. "Syndal," Ross.

1919 Burbury, T. J. "Park Farm," Jericho.

1920 Burdon, R. S., B.Sc.

1922 Burrows, Major, H.O.A.D. The Barracks, Hobart.

1909 †*Butler, W. F. D., B.A., M.Sc., LL.B. Bishop Street, New Town.

1921 Butler, Rev. W. Corly. The Parsonage, Melville Street.

Year of Election.

1917 Butters, J. H. Chief Engineer and Manager State Hydro-Electric Department, Hobart.

1921 Camm, Dr. Carlyle. George Street, Launceston.

1920 Cane, F. B. 90 High Street, Sandy Bay.

1920 Canning, R. W. The University, Hobart.

1919 Chapman, A. D. 105 Macquarie Street.

1912 Chapman, J. R. Holebrook Place, Hobart.

1901 C Chapman, R. W., M.A., B.C.E. Elder Professor of Mathematics and Mechanics in the University of Adelaide. The University, Adelaide.

1913 Chepmell, C. H. D. Clerk of Legislative Council, Hobart.

1920 Clarke, W. I., M.B. Macquarie Street, Hobart.

1896 †*Clarke, A. H., M.R.C.S., L.R.C.P. St. Helens, Tasmania.

1918 Clarke, T. W. H. Quorn Hall, Campbell Town.

1910 †*Clemes, W. H., B.A., B.Sc. Leslie House School, New Town.

1922 Collier, J. D. A. Librarian, Tasmanian Public Library.

1917 Copland, D. B., M.A. Professor of Economics. The University, Hobart.

1920 Cranstoun, Mrs. F. A. 6 Gregory Street, Sandy Bay.

1917 Cullen, Rev. John. Macquarie Street, Hobart.

1918 †Cummins, W. H., A.I.A.C. Lindisfarne.

1919 †*Crowther, W. L., M.B., D.S.O. Macquarie Street, Hobart.

1922 Davern, Miss N. St. George's Terrace.

1922 Davidson, R. Huon Timber Company, Hobart.

1919 Davies, H. Warlow, C.E. Abermere, Mt. Stuart.

1908 †Dechaineux, Lucien. Principal of Technical School, Hobart.

1903 Delany, Most Rev. Patrick. Archbishop of Hobart. 99 Barrack Street.

1892 C Dendy, A., D.Sc., F.R.S., F.L.S. Professor of Zoology in the University of London (King's College). "Vale Lodge," Hampstead, London, N.W.

Year of Election.

1921 Douglas, O. Gordon. 27 Patterson Street, Launceston.

1921 Dryden, M. S. 13 Hillside Crescent, Launceston.

1921 Eberhard, E. C. Charles Street, Launceston.

1919 Elliott, E. A., M.B. Macquarie Street, Hobart.

1918 Ellis, F. Education Department, Hobart.

1921 Elms, E. A. Post Office, Launceston.

1913 Erwin, H. D., B.A. Christ's College, Hobart.

1921 Emmett, E. T. Director Tasmanian Government Tourist Bureau, Hobart.

1918 Evans, L. Acting Director of Agriculture, Hobart.

1921 Evershed, A. E. 65 George Street, Launceston.

1921 Eyre, H. Manual Training School, Launceston.

1902 Finlay, W. A. 11 Secheron Road, Hobart.

1918 Finlay, G. W. Baskerville, Campbell Town.

1918 Fletcher, C. E. Education Department, Hobart.

1909 †*Flynn, T. T., D.Sc. Ralston Professor of Biology, University of Tasmania.

1921 Flounders, A. 102 Patterson Street, Launceston.

1921 Forward, J. R. Mechanics' Institute, Launceston.

1890 L Foster, H., Lt.-Col. Merton Vale, Campbell Town.

1905 L Foster, J. D. "Fairfield," Epping.

1921 Fox, Miss. Ladies' College, Launceston.

1918 Gatenby, R. L. Campbell Town.

1922 Gatenby, Miss M. 5 Berean Street, Launceston.

1908 †*Giblin, Major, L. F., D.S.O., B.A. Government Statistician, Davey Street.

1922 Giblin, A. V. King Street, Sandy Bay.

1918 Gillett, Henry. "Wetmore," Ross.

1920 Gillies, J. H. Macquarie Street.

1918 Gould, J. W. Tramways Department, Hobart.

1907 Gould, Robert. Longford.

1921 Gepp, T. A. Hydro-Electric Department, Deloraine.

1921 Grace, W. L. 91 High Street, Launceston.

1905 L Grant, C. W. High Peak, Huon Road.

Year of Election.		
1922		Gurth, Gordon G. Maria Island.
1921		Hall, E. L. 38 Lyttleton Street, Launceston.
1922		Halligan, G. H., F.G.S. 97 Elphin Road, Launceston.
1913		*Hardy, G. H. C/o University, Brisbane, Queensland.
1918		Harrap, Lt.-Colonel G. Launceston.
1921		Harris, Miss Ila. Studio, Findlay's Buildings, Launceston.
1921		Harris, Dr. R. E. 73 Cameron Street, Launceston.
1921	L	Harvey, David Hastie. "Manresa," Lower Sandy Bay, Hobart.
1902	C	Haswell, William, M.A., D.Sc., F.R.S., F.L.S. The University, Sydney, N.S. Wales.
1913		Hawson, Edward. "Remine," 174 Argyle Street, Hobart.
1919		†Hay, Rt. Rev. R. S., D.D., Bishop of Tasmania. Bishopscourt, Hobart.
1921		Heritage, J. E. 76 Frederick Street, Launceston.
1921		Heyward, F., F.R.V.I.A. 43 Lyttleton Street, Launceston.
1915		Hickman, V. V., B.Sc. "Burnham," Mulgrave Crescent, Launceston.
1919		Higgins, Dr. P. Campbell Town.
1913		Hills, Loftus, M.B.E., M.Sc. Director of the Geological Survey, Launceston, Tasmania.
1921		Hill, A. H. 143 Charles Street, Launceston.
1914		Hitchcock, W. E. Moina, Tasmania.
1921		Hogg, W. Public Buildings, Launceston.
1918		Hogg, G. H., M.D., C.M. 37 Brisbane Street, Launceston.
1922		Hood, F. W. Customs House, Hobart.
1921		Horne, George, V.D., M.A., M.D., Ch.B. 63 Collins Street, Melbourne, Vic.
1921		Horner, A. G. 16 York Street, Launceston.
1921		Hudspeth, R. Parliament Street, Sandy Bay.
1921		Hughes, J. Public Buildings, Launceston.
1922		Hungerford, Mrs. Red House, Fern Tree.
1922		Hungerford, Miss. Red House, Fern Tree.
1909		*Hutchison, H. R. 1 Barrack Street, Hobart.

Year of Election.		
1922		Huxley, G. H. Crescent Road, W. Hobart.
1920		Hytten, T. "Eltham," Bathurst Street, Hobart.
1913		Ife, G. W. R., LL.B. Summerhill Road, Hobart.
1918		Irby, L. G. Conservator of Forests, Forestry Department, Hobart.
1898		*Ireland, E. W. J., M.B., C.M. Launceston General Hospital.
1919		Jackson, George A. 79 Collins Street, Hobart.
1906		*Johnson, J. A., M.A. Principal of Phillip Smith Training College, Hobart.
1921		Johnson, J. D. 142 St. John Street, Launceston.
1922		Johnson, W. Roye. Leslie House School, New Town.
1922		Johnston, J. R. Murray Street.
1922		Jones, Sir Henry, Kt. Campbell Street, Hobart.
1921		Judd, W., M.A. College Street, Launceston.
1921		Keating, Senator J. H. Senate Commonwealth Parliament.
1921		Keid, H. G. W. Geological Survey Office, Launceston.
1911		Keene, E. H. Douglas, B.A. Burnie.
1922		Kemp, Andrew. Stoke Street, New Town.
1922		Kennedy, J. St. George's Terrace, Battery Point.
1910		Kermode, R. C. Mona Vale, Ross.
1913		Knight, J. C. E. "Windermere," Claremont.
1918		Knight, C. E. L., B.Sc. Claremont.
1919		Knight, H. W. National Mutual Buildings, Macquarie Street, Hobart.
1887		†Lewis, Sir Neil Elliot, K.C.M.G., M.A., B.C.L., LL.B. "Werndee," Augusta Road, Hobart.
1919		*Lewis, A. N., M.C., LL.B. "Werndee," Augusta Road.
1912		†Lindon, L. H., M.A. "The Lodge," Park Street, Hobart.
1900		Lines, D. H. E., M.B., Ch.B. Archer Street, New Town.
1921		Listner, J. Parker. Leslie House School, New Town.
1875	C	Liversidge, Professor Archibald, M.A., LL.D., A.R.S.M., F.R.S., F.I.C., F.C.S., F.G.S., F.R.G.S. "Fieldhead," Coombe Warren, Kingston, Surrey, England.

Year of Election.		
1912		†*Lord, Clive E., F.L.S. Director of the Tasmanian Museum, Hobart. "Cliveden," Sandy Bay.
1921		Lord, Chester. "Mellifont," High Street, Sandy Bay.
1921		Lord, Raymond. "Handroyd," 6 Franklin Street, Hobart.
1922		Lowe, H. M.
1921		MacCabe, W. B. Clarence Point, West Tamar.
1922		Macleod, Mrs. L. H. High Street, Sandy Bay.
1919		Mackay, A. D., B.Sc., M.M.E. 4 Fawkner Street, South Yarra, Vic.
1912		McAlister, Miss M. K. Holebrook Flats, Holebrook Place.
1893		*McAulay, Alexander, M.A., Professor Mathematics in the University of Tasmania. The University, Hobart.
1921		McGowan, W. Superintendent of Reserves, Launceston.
1921		McClinton, Dr. R. 70 St. John Street, Launceston.
1921		McInytre, Dr. W. Keverall. 37 Brisbane Street, Launceston.
1902	C	*Maiden, J. H., I.S.O., F.R.S., F.L.S., Director of the Botanic Gardens, Sydney, & Government Botanist of N.S.W. Botanic Gardens, Sydney.
1918		Mansell, A. E. Melton Mowbray.
1918		Martin, Brig.-General W., V.D. Launceston.
1913		Mather, J. F. 1 Mt. Stuart Road, Hobart.
1921		Masters, A. H. A.M.P. Chambers, Launceston.
1895		*May, W. L. Forest Hill, Sandford.
1921		Meston, A. L., B.A. State High School, Launceston.
1909		Millen, Senator J. D. Roxburgh, Newstead.
1907		Miller, Lindsay S., M.B., Ch.B. 156 Macquarie Street, Hobart.
1921		Miller, W. D. & W. Murray Ltd., Launceston.
1921		Miller, R. M. State High School, Launceston.
1894	L	Mitchell, J. G. Parliament Street, Sandy Bay.
1911		Montgomery, R. B. Davey Street.

Year of Election.		
1921		Morris, E. Sydney, M.B., Ch.M., D.P.H., Chief Health Officer, Tasmania. 3 Montague Avenue, New Town.
1918		Murdoch, Hon. Thomas, M.L.C. 55 Montpelier Road, Hobart.
1921		Murdoch, Ronald. "Marathon," Lower Sandy Bay.
1922		Murdoch, F. M. "Lenna," Battery Point.
1921		Muschamp, Rev. E. Holy Trinity Rectory, Launceston.
1882		Nicholas, G. C. "Cawood," Ouse.
1918		Nicholls, Sir Herbert, Kt., Chief Justice of Tasmania. Pillinger Street, Queenborough.
1910		Nicholls, H. Minchin, Government Microbiologist, Dept. of Agriculture, Hobart. Macquarie Street, Hobart.
1919		Nicolson, Norman. "Streanshalh," Campbell Town.
1921		Nye, P. B. Geological Survey Office, Launceston.
1917		Oldham, N., J.P. New Town.
1921		Oldham, W. C. 39 George Street, Launceston.
1919		Oldmeadow, H. E. R. "Lowes Park," Woodbury.
1920		Orr, Dr. Hubert. Campbell Town.
1922		Overell, Miss Lilian. Holebrook Place.
1922		Oxer, Rev. F. E. Huon Road.
1921		Padman, R. S. 56 St. John Street, Launceston.
1921		Patten, W. H. 59 Cameron Street, Launceston.
1921		Parker, R. L. 81 St. John Street, Launceston.
1922		Parker, H. T. Training College, Hobart.
1908		Parsons, Miss S. R. 190 Davey Street, Hobart.
1888	C	Pearson, W. H., M.Sc., A.L.S. 18 Palatine Road, Withington, Manchester, Eng.
1922		Perrin, Miss K. 16 York Street, Launceston.
1902	†*	Piesse, E. L., B.Sc., LL.B. 39 Broadway, Camberwell, Vic.
1910		Pillinger, James. 4 Fitzroy Crescent, Hobart.
1918		Pitt, Frank C. K. "Glen Dhu," The Ouse.
1919		Pitt, C. F. Campbell Town.
1908		Pratt, A. W. Courtney. "Athon," Mt. Stuart Road, Hobart.

Year of Election.

1922 Pulleine, R., M.B. 163 North Terrace, Adelaide.
1922 Reid, A. A. Curator, Beaumaris Zoo. C/o Town Hall, Hobart.
1921 Reid, A. McIntosh. Geological Survey Office, Launceston.
1921 Reid, W. D. Public Buildings, Launceston.
1921 Reynolds, John. Knocklofty Terrace, Hobart.
1919 Riggall, Captain A. Hortin, D.S.O. Tunbridge.
1912 †*Robinson, J. Moore-. Librarian and Publicity Officer, Chief Secretary's Department, Hobart.
1921 Rolph, W. R. *Examiner* & *Weekly Courier* Office, Launceston.
1919 Rowland, E. O. Secretary for Public Works, Hobart.
1884 †*Rodway, Leonard, C.M.G., Government Botanist of Tasmania. Macquarie Street, Hobart.
1913 Ross, Hector, Sheriff of Tasmania. Macquarie Street, Hobart.
1922 Sargison, H. Murray Street.
1921 Savigny, J. 21 York Street, Launceston.
1896 Scott, R. G., M.B., Ch.M. 172 Macquarie Street, Hobart.
1921 *Scott, H. H. Curator of the Victoria Museum, Launceston, Tas.
1922 Seager, P. S., I.S.O. Grosvenor Street, Sandy Bay.
1921 Sharland, M. S. R. C/o *The Mercury* Office, Hobart.
1922 Sharland, Rev. F. B. Davey Street.
1892 C *Shirley, John, D.Sc., Principal Teachers' Training College, Queensland. "Cootha," Bowen Hills, Brisbane.
1921 Shields, Hon. Tasman, M.L.C. 13 Patterson Street, Launceston.
1901 Shoobridge, Canon G. W. 3 Molle Street, Hobart.
1921 Shoobridge, Hon. L. M., M.L.C. "Sunnyside," New Town.
1921 Simson, L. 3 St. George's Square, Launceston.
1917 Slaytor, C. H., F.I.C. Misterton, Doncaster, England.
1901 C Smith, R. Greig, D.Sc. Linnean Hall, Elizabeth Bay, Sydney.

Year of Election.

1921 Smithies, F. 34 Patterson Street, Launceston.

1919 Snowden, Colonel R. E. "Minallo," West Hobart.

1896 L *Sprott, Gregory, M.D., C.M. Macquarie Street, Hobart.

1921 Spurling, S., Jnr. Brisbane Street, Launceston.

1919 Stevenson, Miss F. "Leith House," New Town.

1921 Strike, R. J. Town Hall, Launceston.

1913 Susman, Maurice. 88 Murray Street, Hobart.

1920 Swindells, A. W. 141 Campbell Street.

1907 Tarleton, J. W. Sandy Bay.

1918 Taylor, Walter E. Elboden Street, Hobart.

1920 Taylour, W. H. Equitable Buildings, Melbourne.

1920 Taylour, Harold. Equitable Building, Melbourne.

1922 Thomas, Lt.-Colonel L. R., D.S.O. Registrar of the University of Tasmania.

1921 Thomas, P. H. Agricultural Department, Hobart.

1922 Thomas, L. E. "Creekton," Cressy.

1922 Thomson, E. H. Lower Sandy Bay.

1892 C *Thompson, G. M., F.L.S. Dunedin, N.Z.

1921 Thompson, Dr. L. Grey. Patterson Street, Launceston.

1918 †Thorold, C. C., M.A. The Hutchins School, Hobart.

1921 Tymms, Dr. A. O. 18 York Street, Launceston.

1921 Wakefield, F. W. Forestry Dept., Geeveston, Huon.

1918 Walch, Percy. King Street, Sandy Bay.

1901 C Wall, Arnold, M.A. Professor of English Language & Literature in Canterbury College, Christchurch, N.Z.

1913 Wardman, John. Superintendent of the Botanical Gardens, Hobart.

1918 Waterhouse, G. W., B.A., LL.M., Cantab. Messrs. Ritchie & Parker, Alfred Green & Co., Launceston.

1922 Waterworth, E. N. Poet's Road, W. Hobart.

1921 Waterworth, A. G. State School, Glen Dhu.

1922 Watson, D. W. Hobart.

Year of Election.	
1918	Watt, W. The Observatory, Hobart.
1922	Wayn, Miss A. L. Lambert Avenue.
1918	Weber, A. F. Lands Department, Hobart.
1921	Whitfield, G. Trevallyn, Launceston.
1919	Williams, T. H. Electrolytic Zinc Co., Risdon.
1920	Williams, Hon. W. M., O.B.E. Augusta Road, Hobart.
1922	Winch, A. A. Huon Road.
1901	Wise, H. J. Lambert Avenue, Sandy Bay.
1921	Wright, W. Invermay State School, Launceston.

ANNUAL REPORT

1922

The Council and Officers.

The Annual Meeting was held at the Society's Rooms, the Tasmanian Museum, on Monday, 20th March, 1922. The following members were elected as the Council for 1922:—Messrs. W. H. Clemes, W. H. Cummins, Dr. W. L. Crowther, Major L. F. Giblin, Rt. Rev. Dr. R. S. Hay, Messrs. J. A. Johnson, J. Moore-Robinson, L. Rodway, and Dr. Sprott.

During the year 12 meetings of the Council were held, the attendance being as follows:—Mr. Rodway, 11; Dr. Crowther, 11; Mr. Johnson, 10; Mr. Moore-Robinson, 10; W. H. Clemes, 9; Major Giblin, 9; Dr. Sprott, 6; Mr. Cummins, 4; Rt. Rev. Dr. Hay 3.

The Council at its first meeting made the following appointments:—

Chairman of Council: Mr. L. Rodway, C.M.G.

Standing Committee: Messrs Rodway, Clemes, and Major Giblin.

Editor of Papers and Proceedings: Mr. Clive Lord.

Honorary Treasurer: Mr. J. Moore-Robinson.

Trustees of the Tasmanian Museum and Botanical Gardens: Doctors Crowther and Sprott, Messrs. Clemes, Cummins, Johnson, and Rodway.

Conversazione.

The Society's activities for the year commenced on the 28th February, when a conversazione was held in honour

of the visit of Sir T. W. Edgeworth David, K.B.E., C.M.G., who delivered an instructive lecture concerning the formation of Bass Straits.

Meetings.

During the year one special and nine ordinary meetings were held. Details concerning papers read and lectures delivered will be found in the Abstract of the Proceedings.

Membership.

The membership of the Society continues to be satisfactory, and the roll at the end of the year showed three honorary members, twelve corresponding members, nine life members, and two hundred and forty ordinary members.

Finance.

The financial position of the Society has been the cause of grave concern to the members of the Council. During the year, the Government was approached with the object of obtaining further financial assistance. The then Chief Secretary promised further support, but owing to the change of Government, and the financial position of the State, the hoped-for assistance did not materialise. In order to adjust matters, the Papers and Proceedings for the year were considerably reduced in size. Later a scheme was propounded whereby the Government might undertake the printing of the Society's Papers and Proceedings, and this matter is under consideration at the present time. An appeal for special subscriptions for the printing fund was made during the year, and many members assisted in this direction.

Papers and Proceedings.

The members of the Council regret that it has been found necessary to seriously curtail the size of the Papers and Proceedings for 1922. It is hoped, however, that in the coming year means may be found for overcoming the Society's dfficulty, and the former size of the Society's publication be reverted to.

R. M. Johnston Memorial.

It is hoped to commence the R. M. Johnston Memorial Lectures in 1923. The position of the fund is shown in the financial statement.

Obituary.

It is with regret that the Society has to record the death of the following members during the past year:—

Samuel Clemes, Principal of Leslie House School, New Town. Elected a member in 1887.

Robert Louis Kermode, B.A., Birkedale, England. Elected a member in 1918.

F. M. Littler, Launceston. Elected 1921.

Robert Sticht, B.Sc., E.M., General Manager of the Mount Lyell Mining and Railway Company, Limited. Elected a member in 1896.

It is also with deep regret that the Council has to record the death of Sir Ernest H. Shackleton, Kt. C.V.O., who was an honorary member of the Society.

REPORTS OF SECTIONS

Education and Psychology Section.

President: W. H. Clemes, B.Sc.

Hon. Secretary: T. W. Blaikie.

Nine meetings were held during the year with good attendances. "Suggestion and Psycho-Analysis" was the topic chosen for discussion; the following papers being submitted:—

"Suggestion and its relation to Education." J. A. Johnson, M.A.

"The Teaching of the Nancy School." L. Dechaineux.

"Psycho-Analysis." Dr. E. Sydney Morris.

"The New Psychology and its relation to Education." H. T. Parker, M.A.

"The Effect of Herd Instinct on Morality." W. H. Clemes, B.Sc.

"The Herd Instinct." Major L. F. Giblin.

At the October meeting, the suggestions of the Committee of Public Examinations (Scheme A.), and those of the Board

of Studies (Scheme B.), were discussed, but as no recommendations for the Board of Studies were forthcoming, it was agreed to adjourn the meeting for a week in order to set out the views of the Section for presentation to the Board of Studies. At this meeting, a scheme expressing the unanimous opinion of the members of the Section was drawn up, and forwarded to the Board of Studies.

Historical and Geographical Section.

This Section, which resumed its work in 1921, continued throughout 1922, holding four general meetings as follows:—

14th June. Summary by J. Moore-Robinson of General Macquarie's visit to Tasmania.

12th July. Comments by W. F. D. Butler on Rev. Robert Knopwood's Diary, and Grimes's Journal, on the Survey of King Island and Port Phillip.

16th August. Paper by G. W. Ife, entitled: "Notes on Some Old Hobart Regattas.

26th October. Paper by J. Reynolds on "The Currency of New South Wales and Tasmania, 1788-1825."

Besides papers presented to meetings, the Section dealt with other important matters, including the collection of historical relics, the provision of an exhibiton of articles, paintings, etc., relating to the early days of Tasmania, the preservation of historical monuments in old St. David's and other cemeteries, the compilation of a list of drawings and portraits relating to the early settlement of Tasmania, together with a statement as to where such portraits were to be found, and the preservation of the burial place of William Buckley. Two other matters of outstanding importance were also dealt with, the first being preparation for the erection of a memorial cairn at the spot where Tasman officially landed in 1642, and the other being an elaborate scheme for popularising study of early Tasmanian History by means of establishing special prizes. Both these schemes were advanced definitely during the year, and it is anticipated that they will be finalised during 1923.

BRANCH REPORTS

NORTHERN BRANCH.

REPORT FOR 1922.

There have been six meetings of the Branch during the session of 1922. At the Annual Meeting held in March, the following were appointed the Committee for the year:—Dr. McClinton, Messrs. J. E. Heritage, R. O. M. Miller, S. Dryden, G. W. Waterhouse, Loftus Hills, W. D. Reid, F. J. Heyward, and H. H. Scott.

The following lectures have been given:—

"Standards of Human Progress." W. Judd, M.A.

"The Emotions and James' Theory." R. O. M. Miller, B.A.

"Antarctica." Professor Sir Edgeworth David.

"Other Museums and Ours." H. H. Scott.

"By Camel Train and Aeroplane to Lake Eyre." G. H. Halligan, F.R.G.S.

"Discovery and Settlement of Northern Tasmania." J. Moore-Robinson, F.R.G.S.

Owing to the lamented death of Mr. F. M. Littler, the branch has lost one of its most active and valued members, and the State an enthusiastic worker in the realms of Nature Study.

MIDLANDS BRANCH.

A meeting of the members of the Midland Branch of the Royal Society was held on 4th February, 1922, when there were nine members present. It was resolved that two further meetings be held during the year—one in April-May at Oatlands, and the 2nd in August-September at Campbell Town. These were duly called. At the former, a Lecture on "Science in Modern Warfare" was given by the Director of Geological Survey, and was much appreciated, while at Campbell Town, Mr. Moore-Robinson delighted a good audience with "A Trip through the Panama Canal."

ROYAL SOCIETY OF TASMANIA

RECEIPTS AND EXPENDITURE, 1922. GENERAL FUND

RECEIPTS.

		£	s.	d.
Government Grant in Aid		100	0	0
Sub. 1922.—190 at £1 1s.	£199 10 0			
Arrears—2 at £1 1s.	2 2 0			
In Advance—3 at £1 1s. ..	3 3 0			
		204	15	0
Life Membership Fee		15	15	0
Donations Printing Fund		33	9	0
Sale of Publications		2	6	0
Rent of Room		10	0	0
Hire Lantern, Miscellaneous		1	10	2
Excess Bank Exchange		0	0	6
		£367	15	8

PAYMENTS.

		£	s.	d.
Balance Forward		69	19	4
Salaries		36	13	0
Papers and Proceedings—				
1921	£95 0 0			
1922	45 9 1			
		140	9	1
Expenses Meetings and Advertising		32	11	11
Refund Northern Branch		19	19	0
Library and Insurance		33	18	10
Light and Fuel		1	14	7
Postage and Petty Cash		22	1	5
Miscellaneous		6	2	6
Lantern Operator		1	5	0
Cheque Books (2)		0	7	6
Suspense Account		1	0	0
Credit Balance, 1922		1	13	6
		£367	15	8

R. M. JOHNSTON FUND, 1922

RECEIPTS.	£	s.	d.	PAYMENTS.	£	s.	d.
Interest Received from Perpetual Trustee Co.	13	5	0	Credit Balance, 1922	13	5	0
	£13	5	0		£13	5	0

A Fund has been raised by Public Subscription in order to establish a Memorial to the late R. M. Johnston.

MORTON ALLPORT MEMORIAL FUND ACCOUNT, 1922

RECEIPTS.				£	s.	d.	PAYMENTS.	£	s.	d.
Interest Received from Perpetual Trustee Co.—							Balance Carried Forward	0	0	2
5 Per cent. on £200 War Loan	£10	0	0				Cr. Balance, 1922	9	14	10
Less Trustee Co. Commission	0	5	0							
				9	15	0				
				£9	15	0		£9	15	0

£200 was raised by Public Subscription in 1878 to establish a Memorial to the late Morton Allport. The Fund is invested in the name of the Perpetual Trustees, Executors, and Agency Co. of Tasmania Ltd., and the income is used for the purchase of Books for the Library of the Society.

I have compared the Receipt Book, Vouchers, and Bank Book with items particularised in the Cash Book, and found them to be correct.

R. A. BLACK,
Hon. Auditor.

2nd February, 1923.

J. MOORE ROBINSON,
Hon. Treasurer.

CLIVE LORD,
Secretary.

ROYAL SOCIETY OF TASMANIA, NORTHERN BRANCH

STATEMENT OF RECEIPTS AND PAYMENTS, 31st DECEMBER, 1922

				£	s.	d.
To Balance from last Account				3	4	1
„ Subscriptions	£19	19	0			
„ Interest	0	4	0			
				20	3	0
				£23	7	1

	£	s.	d.
By Advertising and Printing	6	1	0
„ Lecture Expenses	3	3	9
„ Stamps	1	9	0
	10	13	9
Balance	12	13	4
	£23	7	1

J. R. FORWARD,
Hon. Secretary and Treasurer.

INDEX

Titles of Papers, and New Genera and Species in **Heavy Type.**

Date of issue.	Date of issue.	Date of issue.
12.12.57		